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December 15, 1924

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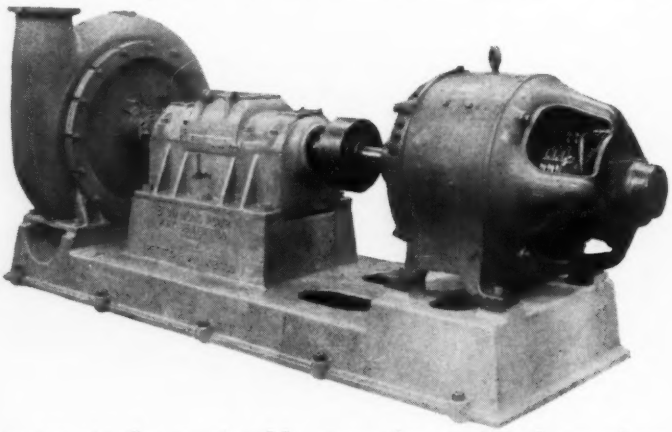

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Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

VOL. 9 CHICAGO, ILL., DECEMBER 15, 1924 NO. 6

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HAROLD W. MUNDAY
Editor

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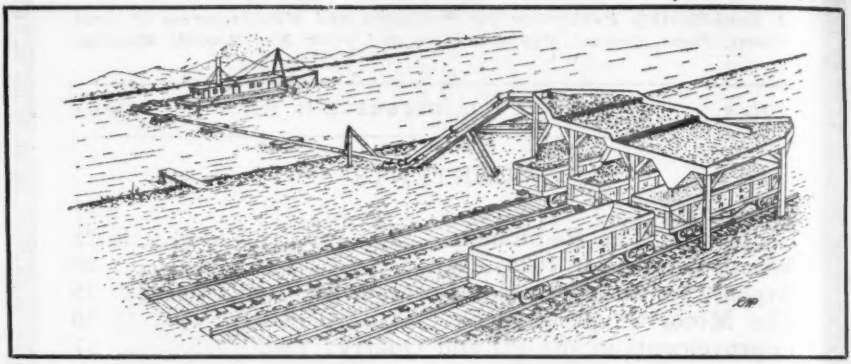
Here's the way to produce sand and gravel for low costs, high quality and quick delivery.



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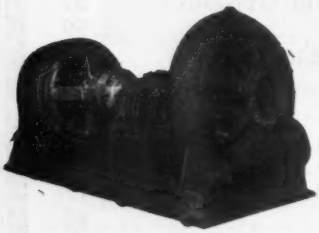

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Pit and Quarry

Vol. 9 Chicago, Ill., December 15, 1924 No. 6

Concerning 1925

AMERICAN industrial leaders are looking forward to 1925 with confidence. Success or failure in these days of highly specialized industry lies in the ability, or lack of it, to correctly interpret the future and to plan ahead. The investments in labor, machinery, buildings and materials bear a profit or a loss not tomorrow but six or eight months from now. Some producers are asking, "Shall I spend any money for new machinery or equipment?" Back of this question is a more general one, "What's Ahead for 1925?"

The commendable desire to look ahead and to plan for the future has its dangers as well as its difficulties. This desire to probe the future has led many an executive to accept defective economic predictions with readiness and later to arrive at false conclusions by their use.

Several months ago many professional economists stated that we were headed for an immediate and serious period of depression. Since that time, and in spite of the damage done by the utterance of these predictions, industrial business has continued on its way until today business is on a firmer foundation than when the depression forecasts were made.

If the industrial executive is to look ahead intelligently into 1925 he must shape his own conclusions on the evidence of substantial facts instead of theories. He must discard the fluctuations of the stock market as an index of industrial prosperity.

Nineteen twenty-five is before you. One year from now it will be a record of your own accomplishments and shortcomings, of your success or failure. No one can tell you what sort of a year it will be for you. It will be the kind of a year that you make it. We are, however, coming into 1925 under very favorable conditions. Earning and buying power are high. Labor unrest is diminishing. American finances are in a strong position and industry is getting as good a start as any preceding year.

Competition will be keen and your competitor will aim to make it keener.

Your gross sales in 1925 may not be as large as they were in 1924, but your profits may be larger. They can be larger even on a diminishing output if you will develop your plant to a maximum efficiency. Investigate your mechanical handling methods. Study the other fellow's production methods. It is easier in some plants to save a dollar through maintenance, better methods, etc., than it is to make a dollar through production.

In meeting the individual plant problems that will come up in 1925, it would be well if each producer could visit other plants than his own to study in detail their production problems. There are certain outstanding plants that would afford a liberal education in modern methods.

Road building and building construction were greater during 1924 than in 1923 and indications are that 1925 in this respect will be even greater than 1924. The development of the Pacific Coast during 1924 should be of much interest to the non-metallic industrial executive. The large number of plants built or started during 1924 on the Pacific Coast is an indication of real development.

The second annual survey of the market for farm lands made by the National Association of Real Estate Boards discloses the fact that better crop prices have already registered in an improvement of the market for farm lands. This indicates that the farmer is already beginning to spend some of his gains and that there is a surplus for buying after paying old obligations. During 1924 there were

more sales in farm lands than in 1923. More acres were sold and better prices were paid. For the country as a whole the gain is about 24 per cent in the number of sales, 44 per cent in the acres transferred and about 65 per cent gain in total prices.

About half of the farm purchases reported are by men who are buying for a home and permanent business. Over eighty per cent are for motives other than speculation.

The automobile industry is preparing to close its books for 1924 in better condition than at any time in the last five years. The financial condition of the industry has shown substantial improvement and that has been the principal problem of the industry in the past. Production has been reduced to a point where it is quite in accord with the demand. Dealers are not overloaded. Retail sales make a favorable comparison with wholesale deliveries. The used car situation is also improving. Prices are now the main consideration of the industry. Adjustments will shortly be made to assure a reasonable profit to all those engaged in the industry.

The world situation continues under the European cloud of unbalanced budgets, unstable currencies and political uncertainties. Yet the Dawes plan and the projects for budget reorganization in France and other countries give hope that we have at last taken a turning. The much discussed European competition will need only serious consideration by such American industries as depend largely upon hand labor. We competed successfully with these countries before the war and should be able to do so in the future. Despite the low wage scale in these European countries they have costly credit, fluctuating currencies and political unrest to contend with. An increased demand for American agricultural products by European countries seems probable during the coming year.

Our own country has exhibited extraordinary strength with progress. The basis of healthy business activity lies in balanced budgets, stable currency, high production accompanied by proportionate consumption and savings with an absence of speculation, extravagance and inflation. These things we have in the United States. We even have hope of decreasing taxes. The outstanding fact concerning the present situation is that as we approach 1925 we have industrial activity, farm prosperity, export demand and easy credit. These four factors have been noted before during periods of prosperity in the country. The odds are favorable to 1925.

Concerning Tax Reductions

IT IS improbable that there will be any immediate action toward tax reduction by Congress. The campaign pledge to lighten the burden of taxation is not to be carried out until the Government ascertains what its income and expenditures for the coming year are to be. This is obvious from the fact that no legislation for tax reduction will be asked from the present Congress by President Coolidge. Undoubtedly the Treasury Department will oppose any revision until the new revenue law has been in operation for a year.

The revenue from the income tax of 1924 was estimated, early in the year, at $450,000,000 less than the annual receipts under the Act of 1921. That estimate was made before the results of the business depression could be ascertained. The forecast for the new levy may, therefore, be less than the revenue will actually prove to be. The revenue for next year will not be known until after March 15 when the income tax returns under the new law will be in and an estimate of the total revenue for the year can be made. Not until then will the Treasury Department know where it stands.

There are many projects that will be urged upon Congress. Another effort will be made to bring about an increase in pay for postal employees. Last year such a bill was passed by Congress and vetoed by the President. A bill will be introduced providing for the expenditure of $50,000,000 for new buildings for the Government in Washington. A number of departments of the Government are in line for a part of this appropriation. This bill is favored by the President. A strong effort to secure large appropriations for naval purposes will be made. If the desires of the advocates for increasing the navy are satisfied, any suggestions for tax reduction will probably be deferred.

What's Ahead for 1925

Some Comments Concerning the Non-Metallic Industries All Firmly Agree Upon Most Promising Outlook for 1925

The outlook for 1925 is of vital concern to all producers. The opinions of others are always of interest. The following comments are extracts from letters received in answer to the inquiry, "What Is Ahead for 1925?" While all comments predict a good year there are many different aspects of the question presented. Many of the comments contain facts that clearly substantiate the predictions presented.

Editor.

T. R. Barrows says,

"Prospects for the sand and gravel industry, taking the country as a whole, are excellent. Most certainly there will be an active demand for sand and gravel, brought about by the large road-building programs and general construction activities as well. During 1923 and 1924 the Federal Government and the states, with their political subdivisions, spent at the rate of more than a billion dollars annually in constructing and maintaining roads. During the coming year there will be $75,000,000 of Federal-aid money available, and state road programs promise to be even greater than in preceding years, such as the one planned by the State of Illinois.

There are two other factors which lend encouragement to the theory, or perhaps conviction is a better word, that the sand and gravel industry is due to have a good business year during 1925. These are as follows: the wide-spread recognition of the necessity of using properly prepared sand and gravel and the economy resulting therefrom, as opposed to the danger which comes from using the inferior materials produced by the wayside or "snowbird" pits; second, the improved transportation service now being afforded the established sand and gravel industry by the carriers as a result of the intelligent nation-wide distribution of open-top equipment by the American Railway Association. As to this latter feature, it is appropriate for me to state here that the established sand and gravel industry is indebted to W. J. McGarry, Manager of the Car Service Division, American Railway Association, for the generous consideration which he has given to the car service problems of our industry. The splendid service which the industry has received this year is sufficient proof of the correctness of the above statement.

The value of yearly construction in the United States is more than five billion dollars. In times of prosperity, there is always great activity in building. As all authorities agree that the country is entering an era of marked prosperity, I cannot see that there is any other conclusion left than that the sand and gravel industry, in common with other major branches of the construction industry, will have a good business during the coming year."

T. R. Barrows,
Exec. Secy., National Sand and Gravel Association.

C. D. Smith says,

"In this section of the country and others where I have been recently, I do not see a "Cloud on the Horizon" that will be detrimental to business of 1925. True, it is early yet to predict what will happen in the construction line, yet there is a general healthy condition properly backed up by good crops throughout the South and West, coupled with good prices for these crops in this section. In this section a large majority of accumulated debts of other years will be paid off, thereby causing the farmer to start another year with a clean slate."

C. D. Smith,
Pres., Memphis Stone and Gravel Company.

Hugh Haddow, Jr., says,

"As to the outlook for 1925 we can say that in the building industry we look for a continuation of the present conditions. We believe that there will be a good demand in the year to come and that most producers can look forward to the next year with confidence. We believe that this industry is in its infancy, and that there are good chances for extensions of the uses of sand and gravel in many branches of industry."

Hugh Haddow, Jr.,
Menantico Sand & Gravel Company.

C. R. Ege says,

"We foresee even more extensive highway improvement during 1925 than in past years. A number of the states which have been especially active in highway improvement have already authorized substantial provision for further activity during 1925. Perhaps the most outstanding of these is Illinois, where a new $100,000,000 bond issue was recently authorized by an overwhelming majority.

Missouri has been active in building the necessary grades and bridges, and received authority at the recent election to proceed with further improvement and with increased funds. The Missouri Highway Department has announced that a paved highway should be completed from St. Louis to Kansas City and from St. Louis to Cape Girardeau by the end of 1925.

Minnesota returned a very favorable vote on the matter of a tax on gasoline to provide funds for road improvement. What will be done in that state during 1925 depends upon legislative action during the early months of the year. However, the way is clear for the legislature to authorize a much needed improvement program if in its wisdom it sees fit to do so.

There is promise of much activity also in southern states. North Carolina has been active for the past three or four years and now has completed the backbone of a splendid system. Indications are that the Legislature to convene in 1925 will authorize a further bond issue of $35,000,000, making a total to date of $100,000,000, so that the activity of the past few years in that state will undoubtedly continue for some time to come.

South Carolina has adopted a pay-as-you-go plan which will provide from four to six million dollars annually for several years. Alabama is the most recent southern state to show strong public demand for extensive highway improvement. At a mass meeting held at the Fair Grounds in Birmingham recently, and presided over by the Chairman of the State Highway Commission, the Governor was requested to convene the Legislature in special session immediately for the purpose of taking necessary steps toward a bond issue of $75,000,000. With the strong favorable sentiment in that state, it seems quite probable that this program will receive both legislative and popular approval.

It seems probable that Tennessee will enact some progressive legislation at the coming session which will provide annual revenues of approximately $10,000,000. Strong sentiment exists throughout the state in favor of highway improvement, and the state Good Roads Association has been fostering this sentiment with a very intelligently planned campaign.

In western states it seems probable that construction will continue at approximately the same pace that has been maintained for the past three or four years. There are no tremendous programs in prospect west of the Missouri River, but improvement from current revenues will maintain, or possibly increase, the present amount of annual construction.

The construction season of 1924, now drawing to a close, has seen a larger amount of concrete roads and streets completed than ever before. About 58,000,000 square yards of new highways have been completed and opened to traffic, and about 30,000,000 square yards of streets. The work under contract and uncompleted on November 1, 1924, totaled 20,500,000 square yards of roads and 7,300,000 square yards of streets. This volume of work will be increased by new contracts awarded during November and December, so that concrete pavement contractors will enter 1925 with more than 30,000,000 square yards of work on their books and uncompleted. New contracts placed during 1924 for concrete pavements totaled 81,500,000 square yards on November 1. It seems reasonable to expect that the volume of similar business during 1925 will reach or exceed 100,000,000 square yards."

C. R. Ege,
Manager, Highways Bureau, Portland Cement Association.

Chas. H. Young says,

"We are anticipating and are preparing for much larger business, both in the city and in country districts, for the year 1925. The city business during the year 1924 has been very satisfactory. There has been very little country business during the year 1924. We are confident that there will be a large demand for concrete aggregates for road building purposes and also a decided improvement in demand for aggregates for building purposes in the country districts during the year 1925."

Chas. H. Young,
Robins, Young Company.

John J. Sloan says,

"It is my opinion that a busy season lies ahead for the following reasons:

First: The conditions of easy money.

Second: The increased earning powers of the railroads with the heaviest freight movement in history.

Third: The added purchasing powers of the farmers due to increased values that are said to total a billion and a half dollars.

Fourth: The increasing percentage of operation in the steel and iron industry, and many other lines.

The railroads will require ballast. The steel mills need flux. The increased prosperity of the country will call for a continuation of good roads construction. Hundreds of millions have been recently voted in different states and counties for improvements, and the general building program is still continued at peak figures with every probability that while the type of construction may change, the volume in materials that pertain to our industry will be equal. With service and delivery, with fairness in price quotation and proper attention to quality, the producer of aggregates has not much to worry about, except to attend to business, and stay on the job."

John J. Sloan,
Pres., National Crushed Stone Association.
Sec., Wisconsin Granite Company.

Burton A. Ford says,

"Undoubtedly the large building boom in several of our big cities has reached its limit, and there will not be the tremendous rush to catch up with building that has been familiar to all of us during the past few years. Nevertheless, there certainly should be a large market for lime during the year 1925 in construction, and we know that the chemical field is growing larger all the time. Likewise, we expect that the increased buying power of the farmer will aid our industry during the coming year as it has in certain parts of the country during this fall season.

Our members throughout the United States are certainly looking toward 1925 with a great deal of confidence. I also believe that the Association, with its research, technical and direct promotional work will continue to do more than its share in the selling of lime."

Burton A. Ford,
Gen. Mgr., National Lime Association.

W. M. Kinney says,

"The ability of cement manufacturers this year to meet greater demands than ever before and still maintain higher stocks in reserve than last year indicates how thoroughly the industry has prepared to serve the construction world. All indications are that the high cement shipments of 1924, which will undoubtedly exceed those of any previous year by about ten million barrels, were the result of conditions that will continue into 1925. Whether next year will equal 1924 is, of course, impossible to say, but demand will doubtless continue good.

In mentioning a continuation of 1924 conditions, I refer especially to the heavy demand for cement for concrete roads and streets, to its widening use in building units—blocks, brick, and tile—and to its growing favor in all sorts of structures from homes to skyscrapers.

With some 4,000,000 new motor vehicles turned out every year, it is evident that more and wider concrete roads are imperative. Building of various classes promises to continue active, despite earlier fears of a let-up.

The producing capacity of the cement industry has been largely increased during the year, and a number of new plants still under construction will come into production within the next few months, so that the industry is prepared for whatever may come."

W. M. Kinney,
Gen. Mgr., Portland Cement Assn.

J. C. Sitterly says,

"We feel quite confident that 1925 will prove a very successful year for our business. By the results of the recent presidential election there has come a general feeling of stability and a desire to go ahead with constructive work.

Our material is used in the construction of gravel roads entirely. With the passage of the 100 million dollar bond issue in this state, and the work that will proceed from that, we in turn will be benefited. Where concrete roads are built, there is immediately a demand for an improvement of "feeders" and tributary roads. These are being constructed of gravel. So we benefit even though material is not used directly in the construction of the concrete road."

J. C. Sitterly,
Pres., Western Sand & Gravel Co.

Fred Witmer says,

"1924 was probably the largest building year in the history of our country not only in dollars and cents, but also in cubical volume. Our output increased about 20 per cent in excess of the preceding year.

According to statistics there will be a carry-over in construction of approximately one billion dollars. The enormous increase in population will require new construction in the amount of about two and one-half billion dollars. Delayed construction work during the war has not all been completed. To this should be added the annual loss through fire, tornadoes and floods, and depreciation or normal repairs to structures. This will give us a total of almost five billion dollars to which should be added the confidence of the buying public in our government.

The railroads are placing large orders for equipment which with the normal building as indicated above will keep the steel plants reasonably busy. With the steel plants reasonably busy, the coal operators and coal miners will be fully employed. The agricultural business has improved and with good agricultural, steel and coal business, we usually have plenty of money and good business in general, as all other lines are dependent to a great extent on these three major industries.

During the past four or five years the old stone and lime plants have been rebuilt. They have also increased their capacities and a great number of new plants have sprung up. It is, therefore, evident that the lime and stone manufacturers will have a greater volume of business, probably keener competition and slightly lower prices."

Fred Witmer,
Sec., Ohio Hydrate & Supply Company.

O. A. Nix says,

"The writer's very modest opinion is that producers in the non-metallic industry should look forward to 1925 with confidence and good heart; it doesn't get one very far to look otherwise if it be actually good, bad or indifferent, except restraining one from unwise expectations of exceptional business. While we understand that the construction industry has had in 1924 one of its greatest years in history from a tonnage standpoint, with only a few notable exceptions, the sand and gravel industry in this immediate section has not prospered in 1924 as in other favored sections. While the tonnage, we understand, has been large, net profits have been small, where existent at all, due to extremely low prices and high operating costs. Some new producers in the territory, without that invaluable experience that goes with years of operation, have sought to place their products by price cutting. They do not seem to realize that price cutting never increased the total tonnage used when prices were at all equitable. Many also do not know their actual costs over an operating season because they lack suitable cost accounting systems. Sand in this section is selling around 20-25c ton f. o. b. pits, and even for a great deal less at some producing points. The majority of operators of experience will frankly and truthfully tell you that it cannot be done at that figure and leave a margin for profit of a decent character.

We believe, however, that with the election settled as the majority of the country appeared to want it settled, with large construction programs still in preparation and unfinished over the country, with tranquil conditions at home, and with more stable business conditions throughout the civilized world, the next two or three years should hold out to the average worker and business man a full measure of hope and confidence in his future well-being. That is our feeling concerning 1925."

O. A. Nix,
J. R. Hime Sand Company.

J. E. Carroll says,

"The prospects for 1925 in the western end of New York State have a rosy hue. We expect to produce and market at least 33 per cent more than we produced in 1924. This applies to our river and lake operations and to washing plants inland.

The dwellers in the country, as well as in the city, have begun to realize the importance of hard surface roads, which means roads built of concrete. Every farmer and dweller in the smaller villages is insisting that roads leading toward larger centers of population be built so that they will be readily accessible from every farm and village.

The hard road is no longer a luxury but a necessity. Trucking operations are supplanting railroad transportation between cities and towns within a hundred mile radius."

J. E. Carroll,
J. E. Carroll Sand Company.

Otto M. Graves says,

"We are optimistic as to business conditions in general for 1925 and for the crushed stone industry in particular. The return of the present administration to office for four years to come by a so overwhelming popular vote has done much to reassure the country and to create a spirit of confidence and optimism.

We see no reason why the railroads should not continue to be heavy buyers and there is no indication of any lessening of highway construction. The demand for crushed stone for all uses in 1925 should at least equal that of 1924, and will probably exceed it.

We may feel a shortage of common labor due to the effect of the recent immigration law becoming manifest, reducing so drastically the permissible quotas from the countries in southern Europe, from which in the past we have replenished our common labor market. It therefore seems advisable for quarry operators to use all feasible means to replace man labor with that of machinery in so far as this may be possible.

It now appears as though there should be a reasonably adequate car supply, with a plentiful production of soft coal, two conditions necessary to a prosperous season for crushed stone producers."

Otto M. Graves,
Vice Pres., National Crushed Stone Association.

W. E. Rogers says,

"Oklahoma has not kept pace with the country in general by achieving a new record for sand, gravel and stone, but on the contrary has been slipping. Three years ago a little wave of prosperity caused expansion of old plants and installation of new plants. Before these increased facilities were completed, there was a marked decline in the demand which has continued for two years.

This, I believe, was due to the over production of oil together with the blows that industry as a whole sustained, as a result of two or three oil companies being investigated at Washington. Oklahoma prosperity is largely dependent upon the oil situation, and, therefore, reflected in other lines. The oil situation at the present writing looks brighter.

Oklahoma has a fairly decent road program, headed by three competent road commissioners, removable only by impeachment, thus removing the Commission from politics. We also have a 2½c gasoline tax, the most of which goes for good roads. I further believe that every rainy day that people ride over what paved roads we have will cause them to vote for more good roads as the occasion arises.

Therefore, 1925 should be better in this locality than 1923 and 1924, but will not reach 1922."

W. E. Rogers,
Pres., Arkansas River Sand Company.

C. L. McKenzie says,

"The year 1925 promises to be a good one in the "aggregate" producing industry. The general feeling of manufacturers is optimistic and hopeful of a greater demand for all kinds of supplies. When manufacturers are busy, improvements are made, requiring concrete aggregate and aggregate for other uses.

The railroads are also in favorable and hopeful situation, and will probably spend large amounts for improvements, including ballast, concrete, etc. Vast amounts of work, and supplies needed in completing this work, are involved in projected public improvements, much money is already available for these improvements, and more will be made available.

The public demand for highways, pavements, power supply, sewer systems, water systems, is whetted and increased by experience and observation of the comforts, convenience, and economy resulting from them. The slowing down of the public improvements, that is likely to come as increasing taxes become more and more painful, will hardly begin to be noticeable in 1925, as the inertia of present motion is too great to permit a sudden stop, especially as the country is very prosperous, and to date can pay taxes, even if they begin to be so large as to be troublesome.

With expansion in employment, some labor scarcity may arise, possibly some transportation delays and the usual accompanying difficulties. Therefore, as usual, the percentage of profit, and the length of time over which the heavy demand will continue, are uncertain. Careful, accurate preparation of product will help any producer. However, to repeat, the year 1925 promises pretty good results for us.

C. L. McKenzie,
Pres., Duquesne Slag Products Co.
Pres., National Slag Assn.

R. N. VanWinkle says,

"I do not feel well enough informed to make a general forecast of conditions in the crushed stone industry for the coming year, 1925, but as far as local conditions—that is to say, conditions in the territory served by our plants—is concerned, they seem to warrant nothing but a feeling of optimism.

Labor conditions are easy; money is plentiful; crop conditions are good; and the people of Iowa, I believe, are coming to realize that good roads are an economic necessity and a blessing of which they have now been too long deprived.

Confidence is the major factor in government and business stability, and personally I consider the sweeping victory of President Coolidge in the recent election a vote of confidence in our government and a direct slap in the face of the radical element whose fundamentals are economically unsound. The election has saved the country from the loss of confidence, which will, I believe, be reflected by a prosperous condition in the crushed stone industry.

There is a message I would like to give the crushed stone producers and that is every producer should be vitally interested in the subject of Scientific Concrete, which is nothing new nor mysterious, but merely a scientific method of producing a dense concrete which has always been the ideal concrete and the concrete for which we have all worked. It will pay every crushed stone producer to thoroughly investigate the methods of producing properly graded crushed stone for Scientific Concrete and to equip his plant to produce sizes and gradation that are demanded by the architects and engineers and expected by the consumer."

R. N. Van Winkle,
Gen. Mgr., Hawkeye Quarries Co.

Edgar Lunn says,

"Next year should prove to be somewhat better than 1924 and almost, if not as good as 1923. Might here state that 1923 was the largest year in our history. Our prediction for 1924 was that it would be as good as 1923, but the actual results were ten to fifteen per cent below."

Edgar Lunn,
Sec., Indiana Limestone Quarrymen's Assn.

A. P. Sandles says,

" 'Twixt optimist and pessimist,
The difference is droll—
The optimist sees the doughnut,
And the pessimist sees the hole.

1925 in Tabular Form:

1. Business barometer going up.
2. Building boom looms ahead.
3. Architects and engineers are busy.
4. Factory fires will burn and wheels turn.
5. Lazy money in banks will go to work.
6. Idle capital is chafing at the bit.
7. Record breaking program of bridge building ahead.
8. Money is ready for biggest road program.
9. Railroads will buy ballast in big contracts.
10. Agstone is out of its swaddling clothes and will break records.
11. The country will "Forward March" at quick step and reach the goal of prosperity.
12. An optimist is a fellow who can see the light. A pessimist is the dunce who tries to blow the light out.

All Aboard—Let's Go."

A. P. Sandles,
Sec., National Crushed Stone Assn.

F. W. Peck says,

"All indications in territory adjacent to Kansas City point to particularly good business during 1925. The agricultural situation in this territory is very much improved, and the tendency is for still further improvement. We believe the last election was a great step toward dissipating the feeling of unrest which has existed in this country for the past several years, and this naturally will be reflected in business throughout the country.

Good Roads Amendment No. 5, which provided for a fifty percent increase in automobile licenses and two cents a gallon gasoline tax, have assured a very extensive road program for Missouri. This amendment carried by an overwhelming majority, and the 24th and 25th of this month some six and a half-million dollars in road contracts were let. This letting is to be followed by several more prior to next spring. Most of this present letting covers concrete road construction. As I see it, the prospects for a good business in 1925 are the brightest they have been in several years."

F. W. Peck,
Pres. Treas., Muncie Sand Co.

Asphalt Industry Regards Future With Confidence

By GEORGE W. CRAIG*

THAT street and road building, upon which the asphalt industry depends for its principal market, next year will far outdistance 1924 for construction is indicated by the vast amount of work involved in federal, state and local highway programs already mapped out. The housing and building industry, which affords another heavy market for asphalt shingles, roll roofings, paints and waterproofings, is also undergoing a decided stimulus and the indications are that there will be no let down in that direction. Wherefore the asphalt industry views 1925 with optimism, believing that the coming year will witness a substantial increase in business over 1923 and 1924.

The two industries of paving and roofing now consume most of the asphalt produced in America, 54 per cent of all asphalt going into roads, 38.5 per cent into roofing and waterproofing and 7.5 per cent into miscellaneous products. The asphalt industry did not suffer from the general trade depression in 1921, for the figures of the U. S. Geological Survey show that asphalt produced that year amounted to 94.5 per cent of the production in 1920. The total asphalt sales, including those of native lake, rock, domestic oil and imported oil asphalts, in 1923 amounted to 2,919,247 tons valued at $33,865,756. In 1922 these sales amounted to 2,499,759 tons with a total value of $27,538,975. The figures for 1921 are 1,957,260 tons sold and $23,924,452 value. The sales for 1920 totalled 2,073,186 tons and their value was $28,539,843. It is at once apparent from these figures that the year 1923 was, up to that time, the banner asphalt year, since the sale of asphalt and related bitumens in the United States increased that year 16.8 per cent over 1922 in quantity. Sales of asphalt have continued heavy throughout 1924 and there is no reason to believe that the showing for the past year will fail to reveal the usual rate of increase in tonnage sold.

*Manager, Middle Western Branch, The Asphalt Association.

According to the U. S. Bureau of Roads the mileage of surfaced highways in this country is now well over 400,000 miles, of which 35,000 miles were constructed in 1922 and 40,000 miles in 1923. It is confidently predicted that the 1924 and 1925 seasons will see close to 90,000 miles of surfaced highways added to the country's network of good roads. This system now embraces 2,819,386 miles of highways, all told. Of the improved roads 175,000 miles are gravel, 100,000 are macadam, 28,000 are concrete, 10,000 are brick, stone block and miscellaneous types and 35,000 miles are sheet asphalt, asphaltic concrete and other asphaltic types.

Due to recognition of their shock-absorbing characteristics under heavy traffic as well as their resistance to moisture and temperature changes, there has been a tremendous increase the past six years in asphalt highways. Last year 108,000,000 square yards of asphalt pavement were constructed,—an increase of 18,000,000 square yards over 1922, and sufficient to construct 10,200 miles of roadway 18 feet wide or to replace all the paved streets in the cities of New York, Chicago, Detroit, San Francisco and New Orleans. The asphalt pavements laid in 1923 too, would provide three roads from the Atlantic to the Pacific coast each 18 feet wide or would form between those points one great roadway carrying six lines of motor traffic.

City types of paving are invading the rural districts to such an extent that, of the types higher than water-bound macadam, asphalt roads now predominate. The extraordinary demand for smooth, shock-absorbing pavements is due to the fact that 16,000,000 motor vehicles now use American highways as well as to the progressive spirit of American rural communities which have come more fully to appreciate the fact that their prosperity is in proportion to their accessibility and is, therefore, largely a matter of good roads. Thus it is that in California, Oregon, Washington, Nevada and Arizona, for instance, the yardage of asphaltic base

("Black Base") pavements alone has increased 800 per cent in six years.

The Michigan, Virginia and North Carolina departments are now using asphalt base pavements on some of their trunk line roads. The Brush College road is the first "Black Base" highway in Illinois. Several other states which heretofore have built rigid pavements are considering "Black Base" for next year.

Asphaltic pavements now comprise 54.9 per cent of all pavements higher than waterbound macadam in the 65 cities of the country having 100,000 or more population. Percentages for other types in these cities follow: brick, 19.9 per cent; wood block 4 per cent; stone block, 14.5 per cent; portland cement concrete 3.5 per cent, and miscellaneous 1.4 per cent. Because of the popularity of the more durable and easy riding city streets, municipal types of paving have taught motorists to demand rural highways.

The year 1924, despite labor unrest and high prices, set a remarkable record in building construction in the United States. In the first nine months, new housing contracts totaled more than during the same period in any previous year of the nation's history.

The value of the new homes constructed during that time is in excess of $2,800,000,000 and is 71 per cent greater than the building contracted for during the same period in 1921.

One feature that investigation of housing construction in 1923 and 1924 has developed, is the great percentage of new homes now being built by laboring men. Another indicates that substitutes for wood are now used in greater volume. These include steel and other metal frames and fittings, asphalt shingles and roll roofings.

Builders of new houses seem also to be taking more to heart the lesson that government officials and conservationists have been driving home for years,—the lesson that the timber supply of America must be conserved. And in learning this lesson they have found not only that substitutes for wood can be used to advantage but that these substitutes make for economy, add to the life of the structure and reduce the costs of insurance and maintenance.

The reports show that the average builder also is demanding all the fire and cyclone protection he can secure without unduly increasing his costs. If he lives in a section where violent windstorms occur, he is laying a roof that will "stay put". Where he encounters heavy fire risks, he is seeking a material that has great fire-resistant qualities. A roofing material of proven merit, both from the storm-resistant and the fire-resistant standpoint, that is now being most widely used is the asphalt shingle.

Manifestly the needs of the nation both in new street and road construction and in providing housing facilities for the people will call for a vast program not only in 1925 but for years to come. In addition there will be, in time, an increased demand for asphalt as material for resurfacing the older roads and streets and for reroofing and repair purposes. There is nothing, therefore, in the immediate present, at least, which would justify anything but optimism as to the future of the asphalt industry.

The Motor Truck Outlook

MOTOR truck production and sales for the year now drawing to a close will make a showing which will compare favorably with practically every other industry, including the passenger car division, according to Otto Stoll, vice-president and general manager of the General Motors Truck Company.

Figures show that the production and sales of passenger automobiles in 1924, for example, will show a decline of probably 9 per cent as compared to the phenomenal record made in 1923. Mr. Stoll estimates the truck industry will not show a decrease greater than four per cent.

"The truck industry has become so necessary to the commercial and industrial life of the nation that it is not subject to a radical degree of fluctuation," said Mr. Stoll. "While it feels the effects of general business retardation, there is a constant demand that must be supplied if commerce is to continue to function.

"The total production of motor trucks in 1923 was 376,293. From present indications, the 1924 figures will not be less than 365,000. This would show a decline from the 1923 figures of about 3 per cent.

"With an active stock market showing renewed faith in the country's industries, better conditions throughout the agricultural sections and indications of increased employment, 1925 should hold still better things for the truck industry."

Improvements and Developments in the Pit and Quarry

By GEORGE B. MASSEY

IN quarry work there has been a decided movement toward the application of caterpillar traction to the standard railroad type shovel. Heretofore these machines have had to be dead-headed back, after making a cut, before a new cut could be commenced. This meant laying track the full length of the cut for this purpose and considerable loss of digging time. The alternative was to turn the shovel around. With caterpillar traction, the shovel can dead-head back with no track laying or can be turned around in a fraction of the time formerly necessary.

Additional advantages to be derived from this form of traction are the elimination of the pit crew, in whole or in part, and the fact that the shovel operator can move up as little as he wishes instead of the full six feed as was the custom with rail traction. He can also move back for any large rock or slide. When working on jack arms, it frequently was necessary to stop to pin up more firmly and it was always necessary to pin up after each move by swinging the boom. On caterpillars, the shovel is always pinned up and no swinging of the boom is necessary. On some shovels, traction wheels have been applied in place of caterpillars.

Oil engines are daily increasing in numbers as a drive for excavating equipment. They have been applied successfully to shovels, draglines, dipper dredges, hydraulic dredges and clamshell dredges. The engines are almost entirely of the vertical multi-cylinder type, either semi-Diesel or full Diesel. The drive is through friction clutches or the engine drives a generator and each operation is driven by an independent motor. In the case of the friction drive, there are nine questions involved in the speed capacity of the clutches, the reversing operation for swinging requiring the most careful design to obtain the best results.

The oil engine-electric drive is the more expensive equipment and is of two general types. In the first type, the engine drives one generator. The motor speed is varied by the use of resistances which are cut out as the motor speeds up under its load. The voltage remains constant and the amperes vary with the load and speed of the motor. In the second type, the engine drives a generator for each motor. Each generator and its motor are in a closed circuit and the torque of the motor is changed by altering the voltage, a low voltage for high torque and vice versa. The motors are direct current machines. An exciter is driven from the engine shaft. The engine is usually direct connected to the generators and exciter. This is really a more ideal drive than steam as an engine stalled under its load will tend to a decrease of power through steam condensation, while the motor torque is steady.

In the consideration of oil engines for this class of work, a full Diesel can be loaded up more continuously to near its related capacity than a semi-Diesel engine. In other words, the rating of the full Diesel is more conservative and the difference in first cost of the two types is not so great when considered in connection with the capabilities of the two types. These considerations have resulted in an increasing number of full Diesel engines being installed as compared with the cheaper type.

Manufacturers of shovels and draglines have made progress along the lines of adaptation of their designs so that they can be used as dragline or shovel by simply changing the boom, handle and dipper for the boom and dragline bucket. Most manufacturers also arrange the gearing and drum ratios so that two-line clamshell and orange-peel buckets may be used.

Full revolving shovels are being built in increasing number as compared with the railroad type of shovel. Very few quarries are adapted to overcasting the overburden with one of these large machines, but it is being done successfully in a few instances and there are doubtless more locations where their use should be considered. Their operating cost is surprisingly low as compared with almost every other method of moving

earth. The trend in quarry cars is toward all steel construction especially adapted to the machine which loads them, the tipple into which they dump and to the minimizing of derailment by a low center of gravity.

Gasoline locomotives are being increased in size and weight and improved in design and workmanship. In place of the friction drive, the gear shift is being used more and more. For light stripping to be hauled a short distance, a tractor drawing self-loading scrapers will beat a small excavating machine loading wagons.

During the past season, several quarries have installed hydraulic stripping equipment after a careful consideration of the different methods available. With proper installation and handling of suitable equipment, this method will accomplish results which can be obtained by no other means. Conditions have to be favorable for the best results. Often such conditions may be created where they do not originally exist. Spoil piles which formerly were moved back each season sufficiently for that season's quarry operation are now being disposed of once for all by the hydraulic method.

The use of hydraulic dredges for sand and gravel recovery is noticeably on the increase. There is also a general improvement in their design, and machinery picked up from various sources is giving way to real dredges designed as a unit with effective power applied to the swinging lines and greater engine capacity so as to meet all emergencies the dredge may have to face.

Oil engines are being applied in increasing numbers driving the pump direct or by belt or rope drive. The direct drive is the best though it does not permit of much speed change. Auxiliaries are driven off the main engine or from another engine, in some cases by belt and, in others, the auxiliary engine is direct connected to a generator which supplies the current for cutterhead drive, winch, service pump and emergency air compressor for starting the main engine. More dredges are being installed with efficient cutter-heads so as to give more positive control over the output than is possible with jets or a plain suction.

In quarry crushing the only line of marked change is in the increased use of reduction crushers in place of small crushers built on the same lines as the primary gyratory crushers. The advantage of using the reduction crusher lies in the greatly increased tonnage it can handle due to the large diameter at the discharge throat.

New Incorporations

The Drew Gravel Co., Little Rock, Ark., has been incorporated for $10,000 to sell and operate gravel pits. Officers are: Harvey Parnell, president; M. E. Sherland, secretary; and E. E. Williams, treasurer.

The Saluda Crushed Stone Co. of Wilmington, Del., was recently incorporated for $100,000 to $200,000.

The Huntsville Stone & Crusher Co. of Huntsville, Tex., has increased its capital stock from $50,000 to $80,000.

The Anchor Block Co., Wilmington, Del., has been incorporated for $500,000 to manufacture and deal in cement, clay, lime, brick and tile.

The Standard Rock Asphalt Co., Bowling Green, Ky., has been incorporated for $500,000 by C. C. Boller and M. C. Ahenberg.

The Gifford Gravel & Sand Co., Dallas, Tex., has been incorporated for $17,500.

The Freeland Stone Company has been incorporated at Sellersburg, Ind., with a capital stock of $40,000 to quarry and crush limestone. The incorporators are Paul E. Freeland, Myron Freeland and Emma F. Freeland.

The City Gravel Company of Texarkana, Texas, has been organized and charter filed in the office of the Secretary of State at Austin. The company is capitalized at $20,000. The incorporators are: G. L. Horton, R. W. Rogers, Jr., and M. H. Edmondson.

Convention Notes

Remember the National Sand and Gravel Association Convention in Chicago at the Auditorium Hotel, January 5, 6 and 7. Also the Road Show which is held in Chicago from January 5th to the 9th.

The National Crushed Stone Convention will be held in Cincinnati at the Hotel Gibson January 12th to the 15th.

The Annual Inventory Valuation With Reference to Income Taxes

Written Expressly for PIT and QUARRY, by D. J. HUTCHINSON

THE inventory is one of the most important factors in the determination of profit or loss. It is also in many cases one of the most difficult to establish. It deserves therefore the most careful attention, particularly in periods of rapidly changing prices when the effect of inventory valuations on income is very great. Moreover, perhaps no item on the books is more frequently questioned than the inventory, either by the Internal Revenue Department or by anyone else who has occasion to examine the balance sheet or earnings statement of a business. The careful determination of inventory values is for this reason doubly important.

To a certain extent this lack of confidence in inventory figures is a heritage from the days when inventory manipulation was a more or less common practice. Before the income tax was levied on business profits, and even during the first few years of income taxation when the rates were relatively low, it was not unusual to treat the inventory as a sort of business safety valve. It was regarded as a flexible item by the manipulation of which profits could be adjusted to conform to the demands of the moment.

If it was desired to show a good profit for the year the inventory was written up. Conversely if the management had good reasons for not wishing to appear to have made too much money, possibly as a means of holding off stockholders hungry for dividends that the management thought it unwise to declare, the most convenient way of reducing profit was to write off or leave out a part of the inventory. Thus the inventory was often determined by entirely extraneous questions of policy having little or nothing to do with the actual value and quantity of goods on hand. Such inventory manipulation was considered perhaps not exactly proper but at least no very serious crime. It served however to engender a habit of viewing inventory figures with some lack of confidence, and while there is doubtless much less of this sort of inventory manipulation at the present time, the tradition that inventory figures are always open to question still continues.

To a large extent also this opinion is still justified owing to the inherent difficulties of arriving at correct inventory valuations even when the problem is attacked with the best intentions, because unless careful attention is given to the methods employed, it is relatively easy to make serious errors in arriving at inventory valuations.

D. J. Hutchinson.

More honest than inventory manipulation but hardly more accurate was the practice, also not uncommon in the past, of omitting the inventory entirely from the periodical calculations of profit and loss. Under this simple but not altogether satisfactory plan it was assumed that the value of the goods on hand at the beginning and at the close of the period would be about the same and that inventories therefore would make little difference in the net result. Such would be the case if the quantities and values of the goods or materials on hand remained about the same from year to year. The errors of this method during periods of stable prices in an industry doing approximately the same volume of business

from year to year were perhaps not serious. But prices have not been stable in recent years, and most businesses have suffered more or less serious fluctuations in volume as well. Hence the importance of proper inventory valuations has increased.

Another factor in the increasing importance of proper inventory valuations has been the fact that income tax rates have varied considerably in the past few years and will probably continue to show considerable variation in the future. Hence it is important from the standpoint of both the government and the taxpayer that each year's income be properly allocated to the year in which it is earned. This can not be accomplished unless proper inventories are taken at least once a year.

The recent income tax laws have therefore given the Revenue Department the right to require inventories whenever in the opinion of the Commissioner they are necessary clearly to determine the income of the taxpayer. Moreover the inventories must be upon "such basis as the Commissioner . . . may prescribe as conforming as nearly as may be to the best accounting practice in the trade or business and as most clearly reflecting the income."* As a general proposition this means that inventories are now required in all manufacturing and trading businesses, since income can not be clearly determined in such businesses without the use of inventories.

The inventory should include the general class of goods, materials, merchandise, etc., purchased for sale or intended for use in the processes of manufacturing products that are ultimately intended for sale. Other items are often erroneously included in inventories, such as stationery and advertising supplies, which should be carried as deferred charges. They are in no sense current assets and they are not intended for sale, therefore they have no place in the inventory.

The classification of the inventory depends on the nature of the business and on the accounting system, but usually the following items are included in one form or another wherever manufacturing processes are involved:

1. Raw Materials.
2. Manufacturing Supplies.
3. Work in Process.
4. Finished Products.

The inventory should also include only items to which the title of ownership resides in the taxpayer, and it should include all such items regardless of whether the taxpayer has actual physical possession of them at the time the inventory is taken. Thus the inventory should include:

1. Material shipped out on consignment or approval to which title has not yet passed.
2. Firm purchases not subject to cancellation for which the liability has been taken into the accounts payable even though the material has not yet been received or paid for.

On the other hand the inventory should not include:

1. Goods held on consignment or approval from others to which title has not yet been taken.
2. Material sold and held for future delivery where the sale has been taken into account, even though the goods are still on hand.

In addition to the errors that often occur in handling the items mentioned above, there are certain other more or less common inventory practices that must be guarded against as being contrary to accepted methods and not in accord with the Treasury Department regulations. Among these practices are:

1. Deduction from the inventory of reserves or allowances for price changes.
2. Deduction from the inventory of estimated depreciation in the value of the goods, materials or merchandise. Such losses are not to be taken until actually realized through the sale or other disposition of the goods. Material however which has actually been scrapped may be included at the scrap or salvage value.
3. Taking work in process or any other part of the inventory at nominal prices or at other than its proper value.
4. Omitting any portions of the actual materials on hand.
5. Using a so-called constant price or nominal value for normal quantities of goods on hand.
6. Including stock in transit the title to which is not vested in the taxpayer.

Regarding the last point whether the title to stock in transit rests in

*Rev. Act, 1924, Sec. 208.

the taxpayer depends of course on the terms of purchase or sale as the case may be, particularly on the F.O.B. point. Goods bought F.O.B. shipping point belong to the purchaser when delivered to the carrier, while the title to goods bought on a delivered basis is not transferred until the goods are delivered to the possession of the purchaser. The same principles apply to outgoing shipments and the terms of the sale will determine whether the title to the goods or materials is in the shipper or the consignee.

In general leaving out of consideration the so-called retail inventory method based on gross profit computations, there are two accepted methods of determining quantities for inventory purposes; the perpetual or book inventory method, and the periodic or physical inventory. Whatever method is used, the taxpayer must be able to show proof of correctness of the inventories as reported.

The principal advantage of the perpetual inventory is that it makes possible the preparation of monthly operating statements for the guidance of the management at times when, due to the press of business and the importance of getting out production, it is not practicable to shut down and take a physical inventory. The perpetual inventory, however, can seldom be depended upon for complete accuracy; and before earnings are finally determined on the basis of which taxes and dividends are to be paid, the book inventories should be carefully checked by actual count of the stocks on hand.

If perpetual inventories are maintained, such count need not be made all at one time with the attendant interruptions to the usual course of business. Different sections of the inventory may be checked from time to time during the year. In the crushed stone and sand and gravel industries, however, no particular hardship is involved in taking a complete physical inventory at the end of the year. In fact this is generally the most practicable plan since the operations in most parts of the country are ordinarily shut down at that time and stocks are usually at their lowest point.

The methods of pricing most commonly used by business concerns and which meet with the approval of the Department are:

1. Cost.
2. Cost or market, whichever is lower.

The cost of goods purchased means the net invoice price after deducting trade or other discounts (excepting cash discounts) to which are added the freight, express, cartage and handling charges incurred in acquiring possession of the goods. Cash discounts may also be deducted from the cost of the goods if this practice is consistently followed. Most business concerns, however, treat the strictly cash discount as a separate revenue item rather than as a deduction from cost. Usually this is the most practicable plan since it cannot always be determined whether the cash discount will be taken at the time the purchase is put on the books.

The cost of manufactured goods for inventory purposes includes:

1. The cost of all materials entering into the product or used in the course of production.
2. The cost of direct labor.
3. Departmental manufacturing expenses including a reasonable proportion of the expenses of management but not including any selling expenses or any return on capital whether taken as interest or otherwise.

Manufacturing concerns operating several departments, or where the sales organization is quite distinct from the producing organization, must be particularly careful to avoid including any interdepartmental profits in the inventory. Thus one crushed stone producer, also in the paving contracting business, was accustomed to credit the crushed stone department for the stone used by the paving contracting department at the same price that the latter would have to pay for the stone in the open market. This practice is permissible in order to show the respective efficiency of the departments, but in taking the inventories it was necessary to eliminate the element of profit from the value of the stock on hand.

Where manufacturing processes, such as stone crushing, produce simultaneously a product of two or more sizes or grades, the cost being about the same for the several products, but each having a different selling value, the total cost may be allocated to the several products in the inventory in the same proportion as their respective selling values.

The term market used in connection with inventory pricing means the prevailing current price at the date of the inventory for the particular kind and grade of material in question when purchased in the quantities that the taxpayer is accustomed to buy. The market basis of valuing inventories is applicable either to goods purchased or to the basic elements in the cost of manufactured or processed goods (material, labor and burden). An exception is made, however, in the case of goods on hand or in process for delivery upon a firm sales contract not cancellable by either party at prices fixed before the date of the inventory, which goods must be valued at cost.

Whichever method—cost, or cost or market—is selected must be followed consistently and applied to each item of the inventory. Estimated and average prices are not acceptable, and every item on the inventory must be separately valued. Also the same method of pricing must be followed consistently from year to year, no change being allowed without special permission from the commissioner.

In general it may be said that any inventory practice which conforms to sound accounting procedure and to the customs and methods prevalent in the industry is acceptable provided it is consistently followed. The department, however, puts great emphasis on consistency in inventory practice, and rightly so, since changes from one method to another, even though both are acceptable methods in themselves, may result in serious discrepancies.

Decrease in Revenue from Taxes

During the first four months of the current fiscal year there has been a decrease of $79,373,464 in internal revenue collections. Compared with last year there is a loss of $22,267,692 in income taxes. The total internal revenue collections from July 1 to October 31 last year were $815,650,888, and this year were $763,167,423. For the same period income taxes last year were $452,387,241 and this year were $430,119,549. Taxes from miscellaneous sources this year are $57,105,772 less than they were last year. This is due to the repeal of some miscellaneous taxes.

New Foreign Lime Plant

Richard K. Mead and Company, 11 E. Fayette Street, Baltimore, Md., have prepared plans and specifications for a large lime plant which is to be built by Ramon Ferreyra, at Cardoba, Argentine. The first unit of this plant will have a capacity of 100 tons of lime daily and will be followed immediately by two other units which will bring the total capacity up to 300 tons daily. A hydrating plant with a capacity of 50 tons a day will also be built and will be the first hydrating plant in the Argentine. The new plant will be equipped with the most modern appliances for the economic production and handling of lime and hydrate.

Hill Note

The Hill Clutch Machine & Foundry Company, Cleveland, Ohio, had a very interesting exhibit at the third National Exposition of Power and Mechanical Engineering held in New York City at the Grand Central Palace during the week beginning December 1st. Mr. A. L. Whiteside, Sales Engineer of the New York Office, was in charge.

The principal products featured were "Smith Type" Hill Friction Clutches, "Cleveland Type" Collar Oiling Bearings, "Industrial Type" Spur Gear Speed Transformers and "Steelarm" Automatic Belt Tighteners. The product of The Hill Clutch Machine & Foundry Company is of sturdy design throughout, dependable and efficient. For nearly half a century this Company's product has been used in practically every industry where power transmission is required. They will be pleased to mail literature to anyone interested in their equipment and particularly to those who had an opportunity of witnessing the exhibit at the Power Show.

Tax Regulations for Corporations

According to Treasury Decision 3645 corporations must file returns with the Commissioner of Internal Revenue by March 15 showing stockholders who have received dividend payments of $500 and over during the taxable year of 1924. This applies to domestic and to resident foreign corporations.

The Economics of Rate Making

Written Expressly for PIT AND QUARRY by JOSEPH H. DONNELL.

IV

The first of this series of articles on the economies of rates and rate structure appeared in the November 1st number of PIT and QUARRY. The elements affecting the carrier's cost of service were discussed in the first and second articles. The value of service and the volume movement of freight were also discussed in the second article.

Handling and the risk involved and railway competition were dealt with in the third article which appeared in the December 1st number. Other forms of competition such as market competition, water competition and commercial competition are discussed in this article. The legal factors of rate making will be covered in the fifth and next article of this series which will appear in the January 1st number of PIT and QUARRY.—Editor.

THE element of competition between markets is another one which has had a distinct bearing on the freight rate structures of this country. The vast area of the United States and the diversity of its products present many problems for the carriers to solve in establishing their rates in such a manner as to permit free competition between commodities in common markets. The principal aim of the carriers in adjusting their rates is to build up traffic for themselves. However, this is best done by adjusting their rates in such a manner as to permit market competition, thus stimulating a free flow of traffic. In order to encourage long haul traffic, rates from distant origins to common markets must be established in such a manner as to permit these commodities to compete with products originating nearer the market. If the element of market competition were entirely disregarded, long haul traffic would dwindle in large measure and the carriers would be compelled to depend largely upon earnings derived from short hauls. This would seriously deplete their revenues. Most shippers desire to secure a wide distribution of their products. Thus the fruit grower of California is in competition in the New York market with the fruit grower of Florida. Iron and steel products from the Pittsburgh district are in competition with iron and steel from the Alabama district. The granite quarry of New England competes in various territories with those of North Carolina and Georgia. The cotton mills of the southeast are in direct competition with the cotton mills of New England.

Joseph H. Donnell

Market competition not only affects individual rates, but also is reflected in rate levels. Some excerpts from decisions of the Interstate Commerce Commission are illustrative of specific products which compete with each other in common markets. In one decision the Interstate Commerce Commission said: "Paint manufacturers in Chicago compete with paint manufacturers in Detroit, Michigan for the trade in the southeast." Ref. Traffic Bureau Toledo Commerce Club, vs. C. H. & D. R. R. Co., 43, I. C. C., 446.

In another case the Commission said: "Minneapolis and Chicago manufacturers of agricultural implements compete with each other in the sale and distribution of their products." Western Trunk Line Rate Increases, 43, I. C. C., 481.

"California Sugar Pine and White Pine Lumber compete with yellow pine lumber from the southwest." Ref. Lumber to Eastern Colorado, 43, I. C. C., 687.

"The relationship of rates from Lehigh and Hudson cement producing district is of great importance because of keen competition in the New

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England market." Ref. Atlas Portland Cement Co. vs. B. & M. Ry., 44, I. C. C., 416. "Rates must be just and reasonable. This is stipulated in the Interstate Commerce act. It is the duty of the Interstate Commerce Commission to see that rates are just and reasonable. In many cases the Interstate Commerce Commission is called upon to approve of rates established in order to permit of market competition. If the rates so established accomplish the purpose and are just and reasonable, in that they allow the carriers a reasonable margin above the cost of service and are not exorbitant considered from the standpoint of the value of the service, further, are reasonable from the standpoint of the risk involved, and the volume of tonnage, such rates would probably meet with the approval of the Commission. If, however, the rates in order to permit market competition in a certain case were unreasonably low, or unreasonably high, or by other standards of reasonableness were not in accord with the provisions of the Interstate Commerce act, approval of such rates would of necessity have to be withheld. The element of market competition in and of itself is not necessarily a determinant of reasonableness. It cannot be so considered by the Commission, but it is an element which is entitled to important consideration. In many cases the carrier may establish rates which are absolutely reasonable from every standpoint and which at the same time facilitate competition between markets as well as between commodities. Rates so established are beneficial to shippers in that this element of competition is recognized and at the same time benefits the carriers through the creation of tonnage. Certain excerpts from decisions of the Commission corroborate the statement that unreasonable rates may not be established merely for the purpose of permitting competition between shippers and markets. The Commission has said, "That increased ratings will curtail shipper's existing markets and reduce their profits are considerations which do not control in determining the reasonableness of transportation rates." Showers Bros. Co. vs. Ann Arbor Railroad, 48, I. C. C., 518.

"It is not the province of a carrier to make its rates so as unduly to favor one market as against another. Its duty is to make reasonable rates to all points." Laird vs. L. & N. Ry., 48, I. C. C., 733. Again the Commission said, "It is not the function of the Commission to equalize commercial conditions or neutralize geographical advantages by such adjustments in rates as will enable a shipper to compete in markets otherwise closed to him." Great Western Sand & Gravel Co. vs. C. M. & St. P. R. R., 45, I. C. C., 529

In a case involving rates on bituminous coal to Central Freight Association territory, 46, I. C. C., 66, the Commission said: "The Commission may not lawfully do or attempt to do anything to neutralize the natural disadvantages which one locality or district or group of mines may have in its competition with another, but carriers in fixing rates may give consideration to competitive conditions, so long as no undue prejudice or undue preference results. And the Commission may properly inquire into such conditions, when the validity of a specific rate or general adjustment is brought in issue."

While the Commission does not recognize market competition per se as a determinant of rates, nevertheless, in many cases brought before it for adjudication the element of market competition plays an important part. The Interstate Commerce Commission must see that all rates are reasonable. If rates are established by the carriers which confer an undue prejudice or discrimination against one shipper or market in favor of another shipper or market, in violation of the provisions of the Interstate Commerce Act the Commission may enter an order requiring that rates be changed so as to remove the discrimination and may award reparation on past shipments. If however, it is determined after investigation that the rates are reasonable per se, even though excluding certain shippers from a common market, the rates would under the provisions of the law have to be permitted to stand as published. To illustrate a typical rate adjustment embodying the principles here mentioned, let us consider the case of Texas and Louisiana lumber competing in Oklahoma markets. In this case the Commission said: "Complainant attacks the rates on yellow pine lumber from its mills in Louisiana and Texas by way of the originating line in connection with the G. C. & S. F. R. R. to points on the

lines of the Santa Fe System in Oklahoma as unreasonable and discriminatory compared with the rates in effect from points off of the Santa Fe System in Texas and Louisiana to the same destination. The rates from the latter point of origin range from 23 cents to 29 cents per 100 lbs. while those from the complainant's mills were from 3½ cents to 5 cents higher. For average distances of 577.1 mile from competitive points the rate was 24 cents, yielding 8.13 mills per ton mile and 18.3 cents per car mile compared with the rate of 27½ cents from complainant's mills for an average distance of 589.9 miles, yielding 9½ mills per ton mile. From complainant's mills to Woodward, Okla., average distance 789.4 miles the rate of 34 cents yielded 8.6 mills per ton mile and 19.3 cents per car mile. The proposed rate of 29 cents would yield 734 mills per ton mile and 16½ cents per car mile. Held, first, that by the adjustment attacked, the A. T. & S. F. R. R. unduly favored mills located on its own line; and, second, that the existing rate for the transportation of yellow pine lumber in carloads from the points of origin involved in Texas and Louisiana to Oklahoma destination were unreasonable and discriminatory to the extent that they exceeded the rates in effect from points on the Santa Fe System in Texas and Louisiana to the same destination." Ref. Lutcher & Moore, Lbr. Co. vs. T. & N. O. R. R., 42, I. C. C., 88

It may be deduced from this decision that discrimination may not be practiced as between shippers when the circumstances incident to the movement of all shipments involved are practically the same. In the Missouri River Nebraska cases 40, I. C. C., 201, the Interstate Commerce Commission recognized a discrimination as between markets and remedied it. In that decision it said: "Policy of commercial equalization has been extensively followed in making interstate rates to Nebraska points from Missouri River Cities, and from Nebraska centers of distribution to points within that state, rate equalization has been required by the Nebraska commission. So long as their competitors in Nebraska are accorded equalized rates, the lower Missouri River Cities, cannot lawfully be denied whatever rate advantages would accrue from rate schedules made upon the same principles." In determining as to what the measure of rates may be upon two commodities in competition with each other in a common market, or on one commodity originated at two origins but selling in a common market, the Commission must be governed by the conditions incident to transportation, rather than by conditions reflected in the sale of the two products caused by varying costs of production" The Commission cannot undertake to equalize manufacturing costs. To illustrate the Commission has said: "In connection with the issue of discrimination competitive conditions must frequently be considered, but it is not within the province of the commission to probe into mining costs as the factor affecting the ability of rival coal operators to compete with each other. This is obvious when we consider all of the elements affecting the question. The cost of mining coal varies greatly, not only by districts, but even by mines. It may and does change from day to day. The character and quality of the coal, the depth at which it is found, the thickness and purity of the vein, the cost and nature of the mining equipment, the wages of the miner, the hours of labor, the efficiency of the organization, the extent of the operation, the output of the mine, the regularity of the demand, the capital invested, the interest paid on loans, and many other elements enter into the determination of mining costs. These ever changing factors afford no basis for a rate adjustment." Bituminous Coal to C. F. A. Territory, 46, I. C. C., 66.

Long standing relationships in rates between competing localities which have been built up for purposes of facilitating market and commodity competition are often disrupted or disturbed by horizontal advances or decreases in rates. It is a well known fact that following every horizontal advance in rates, numerous complaints are brought to the Commission alleging undue discrimination brought about by the disturbing of some relationship between competing points. As illustrative of this point note that the Commission has said: "Percentage increases, especially where the percentage is substantial, cannot fail to disrupt competitive commercial relationships." Ref. The 15% Case, 45, I. C. C., 303. There is a close relationship between carrier competition and market competition. Where serial carriers are in com-

petition with each other for traffic destined to a common market, such competition generally has the effect of depressing the rates to the points involved. As a matter of fact, if the rates were not so depressed by reason of this competition, it is quite probable that the traffic would be attracted to other markets affording lower rates, and thus the carriers would in many cases be deprived of the tonnage. It would go to the carriers serving the other markets. To further illustrate, consider the case of traffic moving from the two great centers of production, New York and Chicago to common markets in the southeast. The manufacturer in New York is in competition with the manufacturer in Chicago, in the sale of his products at Atlanta, Ga. It is to the interest of the carriers serving these respective manufacturers to make their rates such as to enable free competition between the two groups. If the carriers operating from Chicago to Atlanta have their rates upon an unduly high basis, naturally the business will be diverted to the New York manufacturer and the lines running from New York to Atlanta will enjoy the haul. Similarily, if the rates from Chicago to Atlanta, were lower than from New York the Chicago manufacturer would secure the business and the railroads running from Chicago to Atlanta would enjoy the haul of this traffic, thus eliminating the eastern carrier from participation in the traffic. It can be seen from this illustration that there is an element of market competition existing between New York and Chicago on traffic to the Southeast and that this competition also extends to the carriers serving each of these respective origins.

It may be concluded that market competition, like other forms of competition has the general effect of lowering not only individual rates, but rate levels. There are exceptions of course to this rule, when the Commission may decide that in order to remedy an undue discrimination as between markets the lower set of rates should be raised to level of the higher rates. In this case of course market competition has had the effect of increasing the rates rather than lowering them. However, as a general rule market competition lowers rates rather than raises them.

Water Competition

The effects of competition between water lines and rail carriers have left an imprint upon the rate structures of the United States. Water competition perhaps more than any other competitive element affects rate levels to a great extent. It also affects individual rates. Water competition may be of several kinds. It may be actual or merely potential. It exists upon the ocean and likewise upon inland waters. It may be furnished by barge lines or by boat lines. Actual water competition may be described as that which is actually in existence. Potential water competition may be described as that which may be brought into existence by the creation of circumstances conducive to the successful operation of a water carrier. In order to have potential competition there must be a navigable body of water and a physical possibility of ships plying upon it, capable of transporting a volume of tonnage comparable to some extent with that hauled by the rail carriers. Both actual and potential water competition have the effect of depressing individual rates and rate levels. Actual competition is of course far more potent in its effect than potential competition, especially since the Interstate Commerce Act was amended to exclude from the fourth section thereof the words "under substantially similar circumstances and conditions." Prior to this change in the fourth section the Interstate Commerce Commission was permitted in its discretion to permit rail carriers to establish lower rates to certain points because of potential water competition than to points directly intermediate at which no such competition existed. Subsequent to the amendment of the 4th section such departures may be permitted by the Interstate Commerce Commission only in cases involving actual rather than potential water competition. Notwithstanding this fact, potential competition as well as actual water competition have had an important part in the building up of rate structure throughout the country. Ordinarily, rail rates should be and are slight differentials over the water rates between competitive points. This is proper as the rail carriers are entitled to a reasonable measure of additional compensation for the superior service rendered. Rail transportation is usually more expeditious than water transportation and there are many shippers who would rather

pay a slight differential over the water rates in order to secure this service. Such differentials should be maintained within the bounds of reason however as to increase them unduly would tend to divert the major portion of the traffic to the water line. On the other hand to shrink the differential to an unreasonable degree would result in the rail enjoying the preponderance of the traffic at the expense of the water carrier. To illustrate some of the rate structures of this country which have been effected by water competition, consider the case of traffic moving between New England, Eastern port cities, and interior eastern points on the one hand and southeastern points on the other. Traffic from New York City to Augusta, Ga., for example, may move over any one of a number of optional routes. It may move all rail, may move all water, or it may move rail and water. Thus a shipment from New York to Augusta might move over the Pennsylvania Railroad to Potomac yards thence, over the R. F. & P. and the Washington Southern and the Southern Ry. to destination, or it might move by boat from New York to Savannah, thence by boat up the Savannah River to Augusta. Another optional route would be by boat from New York to Norfolk and thence by rail, to Augusta. These competitive traffic routes have resulted in lower rates between New York and Augusta, Ga., than would otherwise obtain.

The transcontinental railroads running across the continent are in direct competition with the water lines operating from coast to coast through the Panama Canal. Water competition on the Great Lakes has had a strong effect upon rail rates between the Atlantic Seaboard and the middle west. Rail rates from the Atlantic Seaboard to the southwest, Texas, Oklahoma, etc., reflect water competition offered by the water and rail routes, operating through the ports of Houston and Galveston. Water competition has exercised an unusual degree of influence on rates in the southeast, due to the presence there of so many navigable streams. The Southeastern territory is surrounded on two sides by the Atlantic Ocean, on the North by the Ohio and Potomac Rivers and on the West by the Mississippi River, with many rivers rising in the interior and emptying into these several bodies of water. Thus, the rate structure in the southeast has been practically built upon the element of water competition, although in recent years there has been a decided tendency to so-called "dry land" rates, which in large measure ignore the water competitive element. This is in keeping with the general tendency towards flexible mileage scales as offering a basis for more or less uniform and stable rate adjustments throughout the several rate territories in the country. Just how these adjustments will work out from a practical viewpoint, it is too early to say. The C. F. A. Rate Structure has been quite desirable and has been predicated upon distance. The C. F. A. Trunk Line adjustment has been very satisfactory, based upon the percentage system.

Conditions in Official Classification territory, are conducive to this form of rate making. Conditions in the south and west are radically different from those obtaining in C. F. A. and Trunk Line territories. It is quite possible though that through a modification of the scales employed in conjunction with classification ratings adaptable to the needs of the respective territories, these rates will afford a satisfactory solution of the rate problems encountered in the south and in the west. Time alone will demonstrate the feasibility of this system of rate making in these territories.

Until the transportation act of 1920 was passed the Commission had no jurisdiction over minimum rates. It had the power to provide maximum rates only. For many years, it was possible for rail carriers coming into competition with water lines to so depress their rates as to drive the water lines out of business. Afterwards, they might again raise their rates to unreasonable levels. This is no longer possible as the Interstate Commerce Commission may now say to a rail carrier, "Your rates may not go below a certain figure." It is thus possible to maintain a relative parity between the rates applicable over these competing routes, thus insuring a fair portion of the tonnage to each. From what has been said, it is readily discernible that cities or towns located upon navigable streams and thereby enabled to secure the advantages in rates which accrue to them through the existence of actual water competition, are fortunate as compared with

other cities or localities not so advantageously situated. There have been cases brought before the Interstate Commerce Commission alleging undue discrimination in favor of such cities because of this condition. In each case of course the decision of the Commission would rest upon the actual conditions encountered. Where the low rates are justified by the existence of actual water competition the Commission has held that such cities may not be deprived of the advantages of their natural geographical locations. Various excerpts from the Interstate Commerce Commission in rate cases involving water competition very lucidly illustrate the effects of water competition upon freight rates. Thus in the case of the city of Memphis, vs. the C. R. I. & P. R. R. Co., 39, I. C. C., 256, the Commission said: "Rates from St. Louis and East St. Louis to Southern and South Eastern Missouri are depressed by water competition on the Mississippi River and are not unduly discriminatory against Memphis although lower for equal distances."

That the effects of water competition may be manifested only within reasonable bounds, is evidenced by the following excerpt from a Commission's decision "The Commission has many times held that discrimination may be justified by water competition, subject however to the limitations that the discrimination must not exceed the real effect of the competition." Texarkana Freight Bureau 38, I. C. C., 55. A rail carrier may determine for itself whether or not it will elect to meet water competition. It may if it so desires forego the traffic and maintain its rates upon a higher level than would be necessary in order to secure traffic in competition with the water line. In this connection the Commission has said: "The Commission has uniformly held that it is for the carriers to determine whether or not they will meet water competition." Rates on scrap iron from Gulfport. 33, I. C. C., 688. That the Interstate Commerce Commission recognizes the direct effect of water competition upon rates is evidenced in the following excerpt from one of its decisions: "With the Panama canal temporarily unavailable, and the enormous demand for ships in the European trade, it seems unlikely that in the near future any great amount of traffic will move by water from the Atlantic Seaboard to the Pacific Coast, at any rate less than 40c." Iron & Steel from Pacific Coast Points, 38, I. C. C., 545. There have been differences of opinion from time to time as to what constituted water competition. In one of its decisions the Commission settled this question by saying: "Competition is a question of facts to be determined by the circumstances in each case. It means something more than an occasional movement via a rail line which paralells the water line, as the rail line operates at a serious disadvantage, in that it does not and cannot offer rates and service on anything like equal terms with the water lines. Whether or not there would be a normal active competition between the rail line and the water line if operating independently of each other is the best practical test of competition." Southern Pac. Co. Ownership of Oil Steamers, 37, I. C. C., 528.

The Interstate Commerce Commission must preserve water competition and not permit it to be destroyed. Before the Panama Canal Act was passed it was possible for rail carriers to control or own outright through stock ownership the water carriers which might afford serious competition. Subsequent to the enactment of the Panama Canal Act, railroads may control or own competing water carriers only where such ownership is in the interest of the public and where the operation of the water line by the rail line neither excludes, prevents nor reduces competition on the route by water. In a case involving the ownership of steamer lines on Chesapeake Bay, 35, I. C. C., 692, the Commission said: "One evident purpose of Section 11 of the Panama Canal Act was to remove the restraint on competition between the rail and the water line, and the showing which would justify the commission in granting permission to continue the operation of both lines is not merely that the existing service and the rates are reasonably satisfactory and have not been the cause of substantial complaint, but that under railroad ownership the lines render service as good as they would render if independently owned and operated, and that railroad ownership does not deprive the public of substantial benefits of competition, either in service or in rates."

In closing this chapter certain decisions of the Commission which show specific cases of rates depressed by

reason of potential water competition should be considered. These decisions indicate individual rates as well as rate levels. "Due to potential water competition, the rates from Albany and Rochester, New York, to C. F. A. territory are somewhat lower than the customary trunk line percentage rates." Eastern Fruit Growers Assoc. vs. the B. & O. Ry., 33, I. C. C., 343.

"Rates to some points east of the Shreveport Group are influenced by potential water competition on the Mississippi River." Memphis Freight Bureau vs. St. L. I. N. & S. Ry. Co., 39, I. C. C., 324. "Rates on lumber from Memphis to Ohio River points have influenced, first by actual and later by potential water competition." Nashville Car Co. vs. L. & N. Ry. Co., 40, I. C. C., 377.

The Commission's decisions also indicate certain rates on specific commodities which are lower by reason of water competition than they would otherwise be. For example the commission said "Low rates on apples to South Carolina are due to water competition." Eastern Fruit Growers Assoc. vs. B. & O. Ry., 33, I. C. C., 343.

"Extremely low commodity rate on agricultural implements in car loads from San Francisco to Portland made to meet water competition." "Rates on Agricultural Implements from San Francisco, 33, I. C. C. 119.

"Water Competition on both the Ohio and the Mississippi Rivers is active and controlling and the rail rates between the water points have been set at a lower level than they might reasonably be were it not for this fact." Class Commodity Rates between St. Louis, East St. Louis and Ohio Rivers Point, 38, I. C. C., 411.

The principal thought to be gained from a perusal of this chapter is that water competition, like other elements of competition whether carrier, market or commodity, has the effect of lowering individual rates and rate levels.

Commodity Competition

The competition of one commodity wth another often affects rate levels and individual rates. This form of competition is somewhat similar to market competition, each reflecting competition for commercial supremacy. It has been shown how in the competition between markets, carriers must so regulate their rates as to permit free competition. So, in the case of competing commodities, must competition be freely permitted thus contributing to the upbuilding of a larger volume of traffic for the carriers to handle. As illustrative of commodities that compete with each other, commercially, let us consider the following: Anthracite coal vs. Bituminous Coal, Lard vs. Lard compounds and cooking oils. Butter vs. Butter Substitutes. Soaps, vs. Soap Products and Washing Compounds. Animal vs. Vegetable Glues. Cooked vs. Uncooked Cereal Foods. Alfalfa Hay vs. Meal. Live Poultry vs. Dressed Poultry. Various Raw Materials vs. Manufactured Products.

In cases involving commodity competition, rates need not of necessity be equal, only relatively so, in other words, the disparity in rates should be no greater than actual conditions incident to the transportation of the traffic would justify. Rates reflecting an exact equality would in many cases be unreasonable and discriminatory. For example, equal rates on a highly valued article, accomplishing in some measure the same purpose as another article of much less value would hardly seem proper. The value of service in one case would be much greater than in the other, likewise the risk of handling. On the other hand, where commodities are of approximately the same value, and other considerations, such as risk, volume of movement, etc., being more or less similar, rates might well be equal for shipments of each commodity moving equal distances. Where commodities compete with each other, the rates for transportation on each should usually bear a relation to the rates on the competing article. Whether the rates are equal or unequal, there should be some form of relationship. The change in a rating or a rate on one commodity will frequently necessitate corresponding changes in the rates on other commodities. Failure to change a rate on a competing article would in many cases disturb a long standing relationship and tend to eliminate one of the commodities from competition with the other. This would have the effect of stopping the traffic.

Commodity competition like other forms of competition usually has the effect of lowering rates, rather than raising them. In the first place commodity competition has a tendency to hold down selling prices. This would necessitate lower rates as it would

render of less value the service performed, and lessen the ability of the commodity to stand the high rate. Secondly, the prevailing tendency in equalizing rates, is to lower the higher rate, rather than to raise the lower rate This is true for the reason that it is the shipper with the higher rate who usually brings the complaint, who is usually discriminated against although there are exceptions to this very general rule. In all cases where manufactured articles compete with raw materials, a proper relationship should be maintained in the freight rates. The disparity in the rates between the two will of course vary with the degree of competition and the nature, and the value of the commodity. Commodities which are more or less similar in physical properties may compete with each other. On the other hand, commodities which are dissimilar in composition, but which are used to accomplish the same purpose may enter into competition with each other. The rates upon each must in many cases not only be made in relation to the other, but with relation to all of the other factors of rate making, such as cost of service, distance, value of service, volume of movement, etc.

Commodity competition may not be accepted as cause for the establishment of rates which are unduly high or unduly low in violation of the provisions of the Interstate Commerce Act. Certain excerpts from the decisions of the Interstate Commerce Commission tangibly illustrate how the element of commodity competition is regarded in the establishment and adjustment of rates. For example, cedar shingles originating in Oregon, Washington and British Columbia, compete in common territories with redwood shingles from California points to the same destination. In a case involving the relative adjustment of these rates, the Commission said: "Complainant attacks the rate of 67c per 100 lbs. on cedar shingles, shipped in carloads from coast points in Oregon, Washington and British Columbia, to Chicago, Ill., St. Louis, Mo., and points in Illinois, Indiana, Iowa, Michigan, Missouri, and Wisconsin as unreasonable and discriminatory compared with the rate of 65 cents on redwood shingles from California points to the same destination. From San Francisco, and Seattle, representative points in California, and the northwestern territory of Oregon, the distances to Chicago were about 2600 miles, and 2200 miles respectively. From producing points to Pacific Coast States generally, the rates on cedar shingles were ordinarily, a differential of 10 cents over rate on fir lumber, and the rate on fir lumber from the coast groups to practically all of the destinations involved was 55 cents. Held that the increased rate had not been justified and that 65 cents per 100 lbs., was a reasonable maximum rate to the destinations involved." Ref. West Coast Lumbermen's Assoc. vs. A. & W. R. R. 44, I. C. C., 443. Competing with each other are foundry facings, core compounds, and foundry flour. Of these commodities the Commission said: "Commodities which are so nearly analagous as foundry facings, core compounds, and foundry flour, which are so in competition with each other should ordinarily be rated the same." Ref. Foundry Supply Mfr.'s Assoc. vs. Ann Arbor R. R., 43, I. C. C., 734.

In the first of the two preceding decisions the Commission in prescribing rates on both cedar and red wood shingles, makes the specific statement that the rates prescribed are reasonable. In the next decision it may be inferred that by reason of the close analogy existing between the commodities mentioned, that equal rates on all three of the commodities would be reasonable.

Consider the establishment of rates on cream as compared with rates on milk. Cream and milk come into competition with each other, but cream is a much more valuable commodity than milk, and moves in lighter volume. While the rates on cream might well be higher than on milk, there should nevertheless be a relationship in the rates on these two commodities. In this connection the Commission has said: "Cream is ordinarily shipped much longer distances than milk, and it is desirable that cream rates should bear a uniform relation to the rates on milk. Rates on cream should not exceed those on milk by more than 25%." Ref. Milk & Cream Rates to Philadelphia, 45, I. C. C., 371.

Fiber pails come into competition with wooden pails, and the Commission has, in connection with these commodities, said: "Fiber pails should take the same rating as wooden pails to which they are analagous from a transportation standpoint, and to which they are to

some extent competitive." Ref. Wood Package Ratings, 48, I. C. C., 708.

Of the competition and rates upon dressed and live poultry the Commission has said "Even if as contended, the dressed poultry should be regarded as a manufacturer's product and the live fowl as raw material, the latter need not necessarily take as low a rate." L. P. & D. Shipper's Traffic Bureau, vs. A. T. & S. F. R. R. 49, I. C. C., 228.

In another case involving rates on analagous commodities, the Commission said: "In considering reasonableness of rates on a particular commodity, comparisons with rates in effect between the same points on comparable commodities are entitled to considerable weight." Atlas Portland Cement Co. vs. Boston & Maine R. R., 44, I. C. C., 416.

Of Cooked and Uncooked Cereal foods the Commission has said: "Rates on Toasted Wheat Biscuit and Krumbles not in excess of rates on Cream of Wheat, Post Tavern Porridge and Rice and other uncooked cereal breakfast foods, prescribed." Kellogg Toasted Corn Flakes Co. vs. the Santa Fe Ry. Co., 33, I. C. C., 534.

Of rates on Butter and Lard, the Commission said: "Butter and lards are not properly comparable from a classification standpoint. The lowest grades of butter may compete with the best grades of lard for baking purposes and the lower grades of lard are in direct competition with various greases, oils, and lubricants rated fifth class in carloads in the Official Classification. Butter is produced largely at creameries scattered through the country while the greater portion of the lard that moves in commerce, is produced in centers where hogs are slaughtered in considerable numbers. There is therefore no certain demand for carload rating on butter as on lard." Providence Fruit & Produce Exchange vs. the Milwaukee St. Paul & Sault Ste Marie Ry., 40, I. C. C., 45.

The above decisions may be accepted as tangible evidence of the very real competition which does exist between commodities and of the fact that rates between competing commodities should bear some semblance of relationship to each other in nearly every case, and in many cases these rates should be on an approximate equality.

Miscellaneous Factors

Seasonal rates:

The term "seasonal rate" is used to designate rates which are applicable during certain seasons of the year. In some cases the application of these rates is restricted to certain seasons, because the commodities which they cover only move during certain seasons. In other cases these rates may apply via rail and water, and in the winter months water navigation may be closed due to suspension of service. In still other cases, seasonal rates may be used to designate those rates which are established for the purpose of encouraging an all year round movement of certain commodities, as in the case of coal, which ordinarily moves in greater volume in the winter time, than in the summer. It has been proposed at various times to establish seasonal rates on coal to be used in the summer time, on a somewhat lower basis than the regular coal rate. It was thought that this would have the effect of stimulating a greater movement of coal during the summer months, thus keeping the mines busy the year round, eliminating the possibility of coal car shortages and during the winter months. Whether or not such rates will become effective is problematical. There is not a great deal to be said in connection with seasonal rates. However, an excerpt from a Commission case will illustrate the application of seasonal rates: "Rates on grain products from Missouri River cities to Virginia ports are equalized during the season of open navigation with rail rates and lake rates in effect to Baltimore and are likewise equalized with the all rail rates via Chicago to Baltimore, during the season of closed navigation on the lakes." Ref. 40, I. C. C., 195.

Prior Rates

In the establishment of current rates, rates formerly effective are frequently taken into account. An increased rate may be alleged to be unreasonable because of the fact that a prior rate has been in effect for many years, under which it was supposed the carrier could profitably handle the traffic. In such a case it may be assumed that the carrier would be called upon to produce evidence of some real necessity for the increase in the rate. The long continuance of the rate presupposes the reasonableness of that rate in the absence of in-

formation to the contrary. If the carrier is able to show that the rate has been an unremunerative one, the Commission would in all probability permit an increase in the rate. The fact that a prior rate may have been lower or higher than a current or proposed rate is not of itself, sufficient justification for prohibiting a change. The fact that it has been effective for a long time, however, is worthy of consideration. As to the relevancy of prior rates in testing the reasonableness of current and proposed rates, the Commission has said: "In a proceeding before the Commission, the history of rates involved is an element to be considered, and sometimes has a material bearing upon the question of what rate should properly apply. This is particularly true where the former rates are shown to have been voluntarily maintained." 43, I. C. C., 662.

In another case the Commission said: "Lower rates having been maintained for many years do not necessarily show that the present rates are unreasonable." Ref. Old Vincennes Dist. Co. vs. B. & O. S. W. Ry. Co., 45, I. C. C., 447.

Frequently the Commission is requested to award reparation, because of past rates which are alleged to have been unreasonable. It should be understood that a rate that is unreasonable today, may not necessarily have been unreasonable yesterday. Nor may it continue to be unreasonable for an indefinite period. Circumstances may change or may have changed, which would render a rate reasonable, which had hitherto been unreasonable. Thus in the case of the Hire's Condensed Milk Co. vs. Pennsylvania R. R. Co., 38, I. C. C., 441, the Commission said: "From a finding that a rate at the present time is unreasonable, it does not necessarily follow that such a rate has been unreasonable in the past and where reparation is claimed because of an unreasonable rate, it is incumbent upon the Commission to enter upon a further investigation of whether or not the rate in the past has been unreasonable, and if so to what extent and for what period." Again the Commission said: In the case of the Federal Glass Co. vs. the C. R. I. & P. R. R. Co., 38, I. C. C., 31, "A rate which is unreasonable when a case is heard or decided may not have been unreasonable when the shipment moved." The relevancy of a prior rate as a test for the reasonableness of current or proposed rate depends entirely upon the information and evidence introduced in connection with each individual case. Sometimes, they are tests of reasonableness and at other times they are not.

Use of Commodity Not a Factor in Rate Making

The rates upon a commodity may not be gauged by the use to which the commodity is to be put. The commission has said: "Carriers may not make rates dependent upon the use to which the commodity is to be put. There is no more justification for a lower rate on coal used for fuel on boats than there would be on coal for use on railroads." In another case the Commission said: "Different rates may not be made on a particular commodity dependent upon the use to which it is put." Catossa Limestone Products Mfg. Co. vs. W. & A. R. R., 38, I. C. C., 614.

This question has also been passed upon by the Supreme Court of the United States and the attitude of the Commission in this matter has been upheld.

Distance As a Factor in Rate Making

For many years, distance was the supreme factor in rate making. It then ceased to be a factor of importance due to the expansion of business and the growth of competition between carriers, between industries and between commodities, to say nothing of water competition. The various forms of competition in conjunction with the cost of service, and the value of service took the ascendancy over distance as a factor to be reckoned with in making rates. Recently, however, the tendency seems to be to go back to distance as one of the principal factors of rate making. This is evident in the plans which have been put forward to revise the rate structures in the southeast, trunk line territory, C. F. A. and Western Trunk Line territories. While none of these cases have yet been decided, it is assumed that a distance scheme of rate making somewhat similar to that used in Central Freight Association territory will be generally used throughout the country within the next few years. Any mileage scales that are proposed must of necessity be more or less flexible in order to be adapted to the needs of carriers, and of business. The next installment will discuss legal factors in rate making.

Developments in Fuel Conservation

Written Expressly for PIT AND QUARRY, by CHARLES LONGENECKER*

THE necessity for a more rigid insistence on fuel conservation is becoming more apparent every year. This is a natural outgrowth and has developed on the one hand from a keener competition among those who sell products in whose manufacture heat plays a part and on the other hand from a fuel supply which is diminishing in quantity and quality and for which a higher price is demanded. This assuredly is the time for manufacturers whether of steam or other products, to keep posted on all developments directed toward the more economical burning of fuel in so far as these development affect his individual requirements.

While there has been no radical development of a revolutionary nature in our methods of generating or applying heat, there has been a decided improvement in prevailing methods. The trend has been not only towards fuel saving but also labor saving.

Fuel saving can be accomplished in three ways as follows:

1. In generating the maximum amount of heat from a fuel.
2. In applying the maximum amount of heat so generated.
3. In recovering as much heat as possible from waste gases, etc.

This order of saving will be followed in enumerating the developments in different lines of manufacture.

Most common of all is the power house containing the boilers for steam generation. While many small boilers are fired by hand those of capacities from 200 H.P. up are practically all fired by stokers or powdered coal. When burning gas or liquid fuel boilers of any capacity can be equipped.

After extensive experimenting on powdered coal fired boilers some years ago it was found that one of the difficulties, up to that time, was insufficient furnace volume. Increasing the cubic contents of the boiler furnace gave greatly improved results. The same reasoning was applied to stoker fired boilers and in this case also much improvement resulted. This development is especially applicable to large boilers.

Improvements in the stoker itself have been mainly in improving air distribution so that the coal is burned more efficiently. This feature is especially true of the "underfeed" type of stoker. Stokers can be divided into three classes:

1. Chain grate stokers.
2. Underfeed stokers.
3. Overfeed stokers.

In the majority of cases manufacturing plants have certain limiting conditions which differentiate it from others. In selecting equipment the conditions must be considered.

One of the most important aids to conservation is that the right type of equipment be installed. Engineers are today giving this feature the consideration it deserves. Practically any grade of coal can be burned successfully if the correct design of stoker is selected. Coals discarded are now burned with good efficiency.

The "chain grate" stoker has been adapted to burn either bituminous or anthracite coal. In Pennsylvania five sizes of anthracite coal, dredged from the bed of rivers into which flows the water from anthracite mines, is being consumed on "chain grate" stokers. In Illinois and Indiana this same type of stoker burns bituminous coal of a low quality. For burning anthracite forced draft is used while stack draft is employed when bituminous coal is fired.

The "underfeed stoker", installed mostly under boilers of comparatively large size, burns bituminous coal. The developments in this type of stoker have been to adapt it to consume the coal more efficiently and for extremely high and variable loads.

The "overfeed stokers" is giving way to the underfeed and is only installed under boilers where the rating need not be over 150 per cent to 175 per cent.

Those responsible for plant performance will conserve fuel by keeping equipment modernized. Manufacturers of stokers are pleased to replace antiquated equipment with modern and the financial considerations, when the fuel saving is determined is in favor of the purchaser.

*Engineer—Combustion Engineering Corporation.

Developments in the boiler furnace for stoker firing have been mostly to save maintenance cost. Various types of furnace arches are now on the market and these are rapidly displacing the older type of "spring" arch.

In recovering heat from the waste gases the economizer and air preheater are receiving more consideration than at any other time. When the waste gases leave the boiler at a high temperature a goodly percentage of the heat can be reclaimed. The air preheater, as the name indicates, returns a very considerable portion of the heat, which otherwise would pass up the stack, by transferring this heat to the air used for burning the coal. The economizer returns the heat by preheating the boiler feed water.

Unquestionably the greatest strides towards fuel saving in the past few years have been made in powdered coal firing. This has not been confined to boilers alone but likewise to industrial furnaces. Not only is a higher return secured from the coal in burning but of equal importance is the fact that very poor grades of coal can be most efficiently burned. In fact this method of generating heat from coal presents the brightest prospects for utilizing our high ash coal.

In several large central stations efficiencies of over 90 per cent are being obtained by burning coal in the powdered form. These stations, of course, are equipped with the most modern appliances not only for increasing efficiency but also for indicating and recording chances and thus assist in maintaining conditions at the peak.

The modern powdered coal fire boiler furnace has a large portion of the furnace walls traversed by open spaces through which a current of air passes. This air not only keeps the walls cool but is itself preheated. From the openings in the wall the air passes into the current of coal from the burner and increases the temperature of the flame. Thus wall maintenance is reduced and efficiently gained. The waste gases leaving the boiler pass through the air preheater mentioned above and here another saving results. In a powdered coal furnace constructed as here outlined the small loss of heat which does take place is in radiation and in that part of the heat impossible of reclaiming in the chimney gases. When these two losses are placed at about 8 per cent it is easy to appreciate the advance which has been made in this type of equipment. It is hard to see where much advancement can be made in this method of consuming coal under boilers.

With stokers a very good efficiency is 80 per cent to 85 per cent. The burning of oil and gas in boiler furnaces does not appear to have much of a future due to the uncertainty of supply and the irregularity of price. Where the cost of oil is low and on shipboard there is a future but, except in some of the southwestern states, there is too much uncertainty to warrant extensive burning installation. One exception is in respect to blast furnace gas, but this is limited in quantity and is confined to a comparatively small output. The Ford plant at River Rouge has one of the most economical boiler plants and in this both blast furnace gas and powdered coal is burned. Oil can also be burned if desired. The supply of blast furnace gas being irregular powdered coal is used to keep the heat supply even as it can be increased or diminished as necessary.

For very small boilers there is now on the market equipment which can be purchased at a very reasonable figure for preparing and burning powdered coal. In considering fuel conservation for boilers the question of control is vital. No matter how excellent the burning equipment may be if the personal element is not taken care of there will be large losses. There has been a decided development towards eliminating, as far as possible, the personal element. Under this heading would come such accessories as CO_2 indicators and recorders, draft gauges, flow meters, soot blowers, draft and air control apparatus, etc.

In the industrial furnace field the advances have been made mostly as refinements of existing equipment and methods. In this field powdered coal has surplanted other fuels to a great extent in malleable iron melting and annealing furnaces. Here coal consumption has been reduced on an average of 300 to 400 pounds per ton of output. On small furnaces for forging, heat treating, etc., oil and gas has practically no competition due to the concentration of heat in these fuels and the ease with which they can be burned in a small combustion chamber.

In large industrial furnaces such as found in steel mill developments

have been directed towards recovering heat from the waste gases. In bygone days efforts in this direction met with little success due to faulty design and construction. The recuperation of heat in these furnaces is accomplished by passing the waste gases through small ducts formed of brick and in parallel or crossing ducts the air which is used for combustion is passed. The heat of the waste gases passes through the thin brick wall separating the gas from the air and raises the temperature of the latter. Savings from 25 per cent to 45 per cent are average. The principle here is the same as in the air preheater for boilers only brick is used for affecting the exchange, instead of metal due to the high temperatures involved.

In cement kiln practice the greatest return has resulted from the application of waste heat boilers. In some instances enough power is derived to operate the entire plant and in many 40 to 50 per cent of plant requirements is secured. The efficiency of the rotary cement kiln is comparatively high and greater efficiency can only be reached by refinements. Radiation losses can only be cut down at the sacrifice of kiln lining. What heat is carried out in the clinker may be recovered but here the cost of the equipment to effect the recovery must not be so great as to counterbalance the saving in fuel. The cement plant operator occupies a very enviable position as a consumer of fuel as compared with other consumers. The coal he purchases need not be of the highest grade as the ash, within reasons, has no deleterious effect on this product. This coal is burned in the most efficient manner and in a most efficient furnace if burned properly. The rotary kiln followed by waste heat boilers completes a most attractive combination for obtaining high efficiency.

The rotary kiln for burning lime presents difficulties when considering powdered coal firing due to trouble from ash. Producer gas and other fuels have so far held the field against powdered fuel. Waste heat boilers on these kilns have been found a very attractive proposition. In one plant 40 per cent of power requirements are being derived from boilers following six kilns.

One of the greatest fuel spendthrifts of today is the coal burning locomotive. It has been estimated that 20 per cent of the coal put in the fire box is blown out the stack. Very little advance has been made to check locomotive waste. Mechanical difficulties are such that the chances for improvement do not seem bright. Extensive experiments were made to adapt powdered coal but, except in Brazil, no locomotives continue to burn this fuel. To burn powdered coal with success there must be a large furnace volume. This is not found in the locomotive firebox. Should an engine be designed and built to burn powdered coal undoubtedly all difficulties would be overcome but such an undertaking entails a financial expenditure which has so far not been forthcoming.

A very promising field for fuel conservation lies in what is known as "low temperature carbonization of coal." There are several barriers yet to be surmounted but if these are swept away the savings both in coal and money will be greater than has ever been obtained to date from a like project. The process is carried out in a type of coke oven retort or a modification of this retort. Coal having a high volatile content is charged into the retort and heated to from 850° F. to 1,400° F. This heat drives out all the volatile gases in the coal excepting about 15 per cent which remains in the coked coal in the retort. The gases driven off the coal are passed through various apparatus and from these gases, sulphate of ammonia, benzol and other oils are derived. The gases are then collected and can be used for fuel as desired. The B.T.U. content of the gas will range from 500° to 700° and there will be approximately 6,000 cubic feet per ton of coal carbonized. The resulting coke makes an excellent fuel for domestic purposes and burns with no smoke. To make such a proposition as this feasible requires a very extensive plant and there must be an assured market for the various products. At the present time much work is being done to perfect this process. At the Ford Motor Company plant at Walkerville, Ontario, Canada, an installation embodying the above described process is being erected. A plant such as the Ford Company operated would provide an outlet for all the products coming from the carbonization process and for such a plant the installation is ideal. The coal desired to make a success of this method of creating gas must be of the right analysis and hence must contain a

fairly high content of volatile matter.

Fuel conservation is born of necessity and this will ultimately force the extended use of our lignites and peat. Developments in this line of endeavor have been very slow but there does appear to be an awakening in the northwestern states and now the burning of lignite on a large scale may be expected in the not far distant future. In the Morris and Company plant in Oklahoma lignite is being pulverized and burned under boilers with great success.

Distillation of the oil shales of Colorado will undoubtedly be performed on a large scale as soon as warranted by economic considerations.

There is no question as to the need for carrying out fuel conservation in the United States but we have become so accustomed to giving this feature slight attention that some time will elapse before we reach the same efficiency as is found in European countries.

Some 1925 Lime and Gypsum Research Suggestions

RESPONDING to a letter from the editorial department of PIT AND QUARRY asking what problems should be considered by the lime and gypsum industry during 1925, Mr. George K. Burgess, Director of the Bureau of Standards suggests the following:

"It would be of material benefit if a method could be devised whereby the amount of sand that should be added to lime could be specified on a weight basis. While it is true that the method of proportioning by volume is more simple it is practically impossible to determine when or when not an excessive amount of sand has been used.

"There are many methods of application to which gypsum products could be put if a method were devised whereby the surface of the gypsum could be 'case hardened.' A few of these which come to mind are the manufacture of sills, door-frames and base-boards. Such a field cannot at present be entered because of the softness of the surface of all gypsum products.

"Evidence seems to indicate that a process of manufacture in which extrusion methods are employed is from a financial standpoint cheaper. There are many difficulties, however, to be overcome before gypsum products can be so manufactured, a few of which include control of the filler to obtain a material which can be extruded and at the same time be not too weighty for use, regulation of the time of set so that the material will not harden until extruded from the machine. If a process of this nature could be perfected it would be an easy matter to extrude gypsum products which would compete with flooring, trim and other such articles commonly made of wood."

The Wisconsin Aggregate Meeting

The 1924 Annual Meeting of the Wisconsin Mineral Aggregate Association will be held at 2:00 P. M. at the Hotel Pfister Milwaukee, Wisconsin, December 18th. The annual dinner and entertainment will be held in the Fern Room of the Hotel Pfister at 6:30 P. M. As in the past the evening will be devoted entirely to entertainment. An enjoyable and attractive program has been arranged. The gathering will consist of a representative group of the industry and officers of allied associations.

Missouri Sand and Gravel Meeting

The Sixth Annual Meeting of the Missouri Valley Association of Sand and Gravel Producers will be held at the Muehlbach Hotel, Kansas City, Missouri, December 16th and 17th. An extensive program has been arranged. Everyone who attends will gain something of value as both business and pleasure have been arranged for.

The entertainment features consist of a luncheon and moving picture party for the ladies, a theater party for all one night, a banquet the other night and a sight seeing trip on one afternoon.

Aldrich Pump Equipment

A new bulletin, *Pump Data 82*, just issued by The Aldrich Pump Company of Allentown, Pa., describes the Aldrich "Utility" High Pressure Road Pumps, especially built for contractors. The book has 8 pages and is illustrated with engravings of various road pump units, and detailed descriptions. Pumps for every service are built for industrial uses, pressure tank systems, spraying outfits, boiler feed, and construction work.

Effects of Temperature and Pressure On Gypsum and Anhydrite

By MARIE FAINSWORTH*

THE Nonmetallic Minerals Experiment Station of the Bureau of Mines at Rutgers University, New Brunswick, N. J., has recently undertaken a study of the chemical and physical properties of anhydrite having in view its wider utilization. Anhydrite ($CaSO_4$) in contact with water at ordinary temperature and pressure rehydrates, slowly forming gypsum ($CaSO_4\ 2H_2O$). In nature this is an extremely slow process, and laboratory experiments are being conducted to determine methods of accelerating the rehydration. The tests recorded herein cover one small part of this study, and while they are negative in character in so far as the major problem is concerned, certain facts established by the tests, bearing on the stability relations of gypsum and anhydrite seem sufficiently important to be placed on record.

Early Researches on Gypsum and Anhydrite

It is to Lavoisier that we owe the first scientific study of the calculation and hardening of plaster of Paris. He sums up his experiments in the following passage: "If gypsum, which has been deprived of its water of crystallization by means of heat, is again treated with water (to make what is commonly called mortar) it takes it up with avidity, a rapid and irregular crystallization occurs, and the small crystals which are formed are so entangled in each other that a very hard mass results." Later, he observed that the dehydration of gypsum occurs in two stages: three-fourths of the combined water is much more easily driven out than the last fourth. LeChatelier first determined the temperature of decomposition accurately. His method was as follows: Pulverized gypsum was placed in a glass tube in the middle of a paraffin bath, the temperature of which was raised in a progressive and regular manner. A thermometer gave at each instant the temperature of the salt, and the passage of the mercury column past each division of the stem was marked by a registering chronograph. The rise in temperature was regular except at 128°C. and 168°C. where breaks occurred. On analyzing for moisture he found that at 128°C. the material contained one-half molecule of water while that at 168°C was completely dehydrated.

While rapid decomposition of the dehydrate to form the hemi-hydrate does not occur until about 128°C., anhydrite is the stable form above 60°C., as shown by the solubility curves of Melcher. He determined the solubilities of gypsum and anhydrite at different temperatures and found that the anhydrite curve cut the gypsum curve at 60°C. While it is possible to form anhydrite at that temperature, it is not a practical method as the dehydration is extremely slow. In the same manner, anhydrite rehydrates below 60°C. but only with extreme slowness. Gill found that both anhydrite and dead-burned gypsum had set after six years standing; the dead-burned gypsum more completely than the anhydrite. Many people have investigated the dehydration of gypsum at atmospheric pressure, a process employed commercially every day in the manufacture of plaster of Paris and Keene's cement. However, the action of gypsum and anhydrite under pressure has been studied very little. As long ago as 1865, Hoppe-Seyler found that if gypsum were heated in a closed tube to a temperature of about 130°C., needle-like crystals of the hemi-hydrite were formed. The pressure at 130°C. is only about 1.5 atmospheres, and since he did not carry the experiments to higher temperatures, his results are not very conclusive.

Volume and Pressure Relations of Gypsum and Anhydrite

From a study of the volume of gypsum and anhydrite, it appears that gypsum should be the stable form under high pressures. One thousand grams of gypsum occupy a volume of 431 c.c. since gypsum has a density of 2.32; this weight of gypsum de-

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composes to give 791 grams of anhydrite and 209 grams of water. The anhydrite having a density of 2.96 would occupy a volume of 267 c.c.; the water would occupy a volume of 209 c.c.; the total volume would thus be 473 c.c. Therefore, since the combined volume of the anhydrite and water is more than the volume of gypsum, pressure should tend to form gypsum from anhydrite and water. In the two-component system—and hydrite and water—the three phases, solid, liquid and vapor, from the phase rule P+F=C+2, F must equal one or there can be only one variable—that is, if one varies the temperature, the pressure must vary with it.

Method Employed and Results Obtained

The method of testing the effect of high temperature and pressure on gypsum and anhydrite was as follows: The solid, either gypsum, artificial anhydrite, natural anhydrite or precipitated anhydrite, was sealed in a test tube with an equal volume of water so that a liquid phase was always present. Very heavy pyrex test tubes were used to withstand the pressure. The tubes were then heated in an oven for a period of 48 hours at temperatures varying in steps of 10° from 100° to 210°C. They were then opened, the water filtered off and the solid dried for several hours at 45°C. to remove surface moisture. In order to determine the combined moisture, the solid was heated to constant weight in a platinum crucible at about 250°C. The gypsum used was chemically pure selenite ground to 200 mesh; the artificial anhydrite was prepared from the selenite by heating to constant weight at 450°C.; the natural anhydrite was a very pure sample from Gypsum, Ohio, analyzing 93.59 per cent anhydrite, ground to 200 mesh; the precipitated anhydrite was an analyzed sample from Baker and Company. On heating the three samples of anhydrite as described above at temperatures from 100° to 210° in steps of 10°, practically no change in moisture content was observed. The samples did contain a small amount of water, from 0.2 to 1.5 per cent, and after heating to about 120°C. the amount decreased somewhat. This decrease was not regular and was too small in amount to be conclusive. The same experiments were then repeated, using gypsum instead of anhydrite. At 100°C. no change was observed; at 110°C. about one-half the gypsum changed to needle-like crystals of semi-hydrate; at 120° C. the change into needle-like crystals of the semi-hydrate was complete. This continued until 160°C. where the material changed into anhydrite; from 160° to 210°C. anhydrite was the product obtained. In all the above cases, the water was in contact with the solid. On putting the solid in a smaller test tube inside the sealed one so that it was in contact with vapor but not with liquid, no difference was observed except that equilibrium was reached somewhat more slowly. Assuming that the pressure in the tube is that of pure water, an assumption that is practically correct owing to the very small solubility of anhydrite and gypsum, 160°C. corresponds to a pressure of about 6 atmospheres, and 210°C. to a pressure of about 19 atmospheres.

The above shows that a pressure of 19 atmospheres has no effect on anhydrite and water under high temperature conditions. In fact, dehydration of gypsum with rising temperature takes place practically the same in the tube as it does at atmospheric pressure. This is not a surprising result considering that anhydrite is the stable form above 60°C. These results bear out those of van Hoff who measured the vapor pressure of the water of crystallization of gypsum in equilibrium with the half-hydrate at different temperatures by a number of ingenious methods. From these measurements it would appear that the vapor pressure of gypsum in forming half-hydrate becomes equal to one atmosphere at a temperature of 101.45°C., while at a temperature of 107° the vapor pressure of the water of crystallization of gypsum becomes greater than the vapor pressure of water itself. A temperature of 107° is therefore, the transformation point of gypsum into half-hydrate when in contact with water; that is to say, when gypsum is heated (under pressure) with water to a higher temperature than 107°, the half-hydrate should be formed; below 107°, water should convert half-hydrate into gypsum. In the presence of aqueous solutions having a lower vapor pressure than water the temperature of transformation of gypsum into half-hydrate is lowered.

These tests indicate that anhydrite can not be rehydrated under high temperature and pressure.

Reducing Accident Hazards

By FRANCIS A. EMMONS*

WHAT a marvelous thing is the harnessing of nature's forces by man! Consider how he has gradually bent to his will the winds, water power, steam, electricity, the driving power of gasoline and the Hertzian waves of radio. Try to visualize the progress step by step in the development of the mechanical contrivances and machines through which we apply power of different kinds to modern industrial operators. Then compare the productive capacity of the craftsmen of a hundred years ago with the output of a modern automatic machine capable of doing the work of a small army of men. The craftsman of course could not hope to compete with the output of the modern machine, but he did enjoy one considerable advantage over the industrial worker of today and that was comparative freedom from accident hazards.

Humanity and Self Interest Demand Protection of Workers

Power no matter how controlled or applied is still power. Machines and moving parts can not be instantly stopped and consequently the worker of today is always exposed to the hazard of death or mutilation from the machinery and transmission equipment near which he works. Humanitarian motives generously prompt most employers to use every possible means of reducing working hazards to a minimum, but even if this motive were disregarded entirely, it is greatly to the employer's interest to eliminate every possible danger in order to avoid the losses incident to expensive lawsuits and interrupted production.

General Classes of Industrial Hazards

Industrial hazards may be roughly divided into six general classes:

1. Hazards due to transmission equipment
2. Hazards due to moving machinery
3. Hazards from explosions, fire, scalding and molten metals
4. Hazards from poisonous fumes and from handling poisonous materials
5. Hazards of drowning or suffocation
6. Miscellaneous hazards.

In the past few years much attention has been devoted to the protection of the worker by safety devices of various kinds, covering of exposed moving parts, and automatic devices attached to saws, punch presses, drills, etc. Open transmission equipment, however, is still an ever present menace to the lives and limbs of workers, and it is to this particular phase of the study that we shall confine our discussion in this article.

Transmission Equipment

The necessity for transmission equipment is due to the fact that driven machines nearly always operate at a lower speed than the prime mover, therefore a means must be provided to step-down speeds to the proper figure. We may define as transmission equipment those devices which are used to deliver power from the prime mover, or source of power, to the driven machine. Comprised under this head are belts, pulleys, shafting, chains, sprockets, rope drives, open gearing of various kinds, and enclosed speed reducers.

The hazards from open transmission equipment are obviously tremendous. Belts, pulleys, chains and open gearing travelling at great velocities and driven by power reaching in some cases, as high as several thousands horse power, present a constant menace to workers in the vicinity. Loose clothings, sleeves, belts or the hair of the worker coming in contact with these moving parts result in horrifying accidents and death or mutilation of the victim. Accidents of this description are of all too frequent occurrence and it is amazing to think that in a great many industrial plants these conditions are still allowed to exist when safe transmission equipment is readily available.

Enclosed Speed Reduction Units Eliminate Hazards

The safest and most modern method of transmitting power and obtaining speed reduction of the desired ratio is through the use of unit enclosed drives known as Speed Reducers. These machines are somewhat similar

*Foote Bros. Gear and Machine Company.

to the transmission of an automobile in that they consist of trains of gears enclosed in a suitable case or frame, but they differ in that they are designed to operate at a fixed ratio of reduction instead of variable ratio as in the state of the automobile transmissions.

The frame resembles that of a motor as will be seen from the illustration below of the IXL Non-Planetary Speed Reducer of the Foote Bros. Gear & Machine Company of Chicago. It will be noted that the gears are entirely enclosed, operate in oil and have no exposed moving parts to endanger the life and limb of workers in the vicinity.

The reducing unit is so constructed that power is delivered to one end called the high speed end by the prime mover and the desired speed reduction is obtained through the various gears in the machine. The power is then delivered at the reduced speed to the slow speed shaft which is concentric with the high speed shaft.

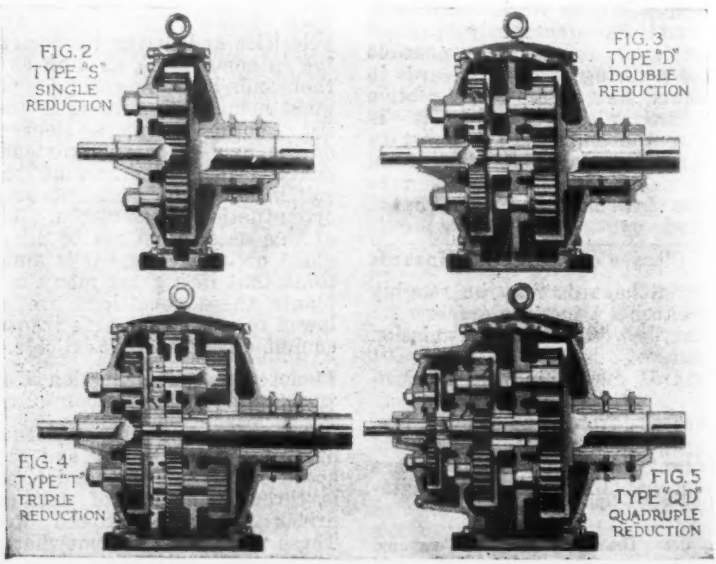
In installing a speed reducer it is only necessary to connect the high speed shaft through a flexible coupling to the motor or other source of power and connect the low speed shaft through another flexible coupling to the machine to be driven. In this way it is possible to eliminate the belts, pulleys, hangers, shafting and exposed open gearing usually employed.

Types of Speed Reducers

There are three main types of Speed Reducers on the market which have the same general appearance and accomplish practically the same results although they differ somewhat in design and in the methods used to secure the desired speed reduction. The first type is the straight spur gear type in which a pinion delivers power to the larger gears each of which is keyed to a smaller gear. These three small gears in turn drive another pinion centrally located. This pinion drives another set of gears and so on till the desired reduction is obtained. The second type is the planetory type using a fixed internal gear. In this type the power is also delivered to the pinion as in the spur gear type, and the pinion delivers the power to idler gears which are rigidly journalled to a drive plate. These gears mesh with the fixed internal gear causing the three idler gears and plate to revolve as a unit. The next pinion is fastened to the drive plate and drives through three more idler gears as before. The third type is the non-planetary internal gear type which has certain marked advantages and will be described in greater detail.

Non-Planetary Speed Reducer

In the design of this machine, the power is delivered to a pinion revolving between three idler gears which are rigidly journalled to parts of the



frame. These idler gears in turn, transmit the power to a large internal gear that is free to revolve. In this way the strain is ideally distributed to the idler gears and the final horsepower is taken from the largest possible leverage which is the pitch radius of the large internal gear.

It should be borne in mind that nothing revolves in the gear case except the gears on their own centers. There are no heavy unbalanced units; vibrations, centrifugal force and oil leaks caused by internal pressure, are eliminated.

The slow speed pinion is keyed to the high speed internal gear, and for greater speed reduction engages with another set of idler gears which in turn drives another internal gear. Thus it is apparent that it is possible to secure almost any reduction ratio by simply increasing the number of gear trains and varying the ratio of the pinions and gears.

The cuts below illustrate the simple construction of the single reduction unit, also the double, triple and quadruple type, simple and compounded. Any speed reduction from 4-1 up to 320-1, is covered by the different types shown and reduction ratios as high as 50,000-1 may be secured by combinations of spur gear reducers. Available sizes range from fractional horse power to several hundred horsepower.

Many Other Advantages Besides Safety

The Spur Gear Speed Reducers are entirely enclosed and run in a bath of oil. They are very compact, take little space, deliver power with very little loss, and the driving and driven shafts are axially concentrix.

The chief advantages of the enclosed speed reducer units are:

(1) Safety to operators and attendants because reducers are fully enclosed and there are no moving parts.

(2) Elimination of fire and explosion hazards resulting from hot bearings on line shafting as in grain mills, elevators, coal mines, etc.

(3) Efficiency because the drive is positive and there is no lost power due to slippage, etc.

(4) Constant speed reduction.

(5) Long life, because they are self-lubricating and there is no possibility of deterioration from dust, dirt or grit, or acid fumes in the atmosphere.

(6) Require practically no attention except to renew oil at three month intervals.

(7) Eliminate production delays, because there is no necessity for adjustments on belts, slide rails, etc.

(8) Maintenance charges practically nothing.

(9) Permit the use of high speed motors which cost less and are more efficient and easier to secure.

(10) Conserve space and allow installation of productive equipment in space formerly occupied by belts, slide rails, hangers, shaftings, etc.

(11) Better working conditions for employes, better light on account of elimination of shadows from belts and shafting.

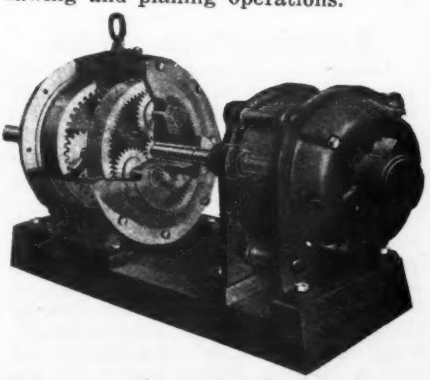
Uses and Applications

Spur Gear and Worm Gear Speed Reducers are being widely used in nearly every industry and are being extensively specified by designing and consulting engineers for new equipment. They are particularly well adapted for operating screw, belt and bucket conveyers, stockers, feeders, hoists, elevators, rotary kilns in cement plants, car pullers, agitators, slurry tanks, water screens, crushers, grinders, dyeing and bleaching machinery in textile plants, for driving line shafting and operating coal and ash handling equipment in boiler room.

The uses and applications are almost innumerable and the list below covers only a few of the main industrial operations where speed reducing units are now being used with gratifying results:

Cement Mills—for driving rotary kilns, slurries, grinders, mixers, elevators, conveyors, etc.

Lumber Mills—for conveyers and feeders in connection with the various sawing and planing operations.



Foote Bros. Speed Reducer.

Coal and Metal Ore Mines—for conveyors, elevators, ore roasters and crushers.

Grain Elevators—for elevator legs, cleaner house conveyors, etc.

Glass Factories—for lehr and elevator drives.

Automobile Factories — for assembly conveyors.

Brick Plants — for conveyors and machinery drive.

Coke By-Products—for belt conveyor drives, pumps, etc.

Cereal Mills—for cookers, pumps, elevators and conveyors.

Textile Mills—for driving manufacturing machinery.

Paper Mills—for driving agitators and filters.

Steel Mills — for driving roller tables.

Plating Rooms—for agitator tank drives.

Rubber Mills—for conveyors, rolls and mixers.

Starch and Glucose Mills—for conveyors, mixers and drives.

Paint and Chemical Mills—for mixers, conveyers and crushers, paint chasers and dryers.

Machine Shops—for lime shafts, veyors and material elevator drives.

Sugar Refineries—for screw conveyors and material elevator drives.

Boiler Rooms—for coal conveyors, stokers and ash conveyors.

The reduction of hazards on transmission equipment is a subject worthy of the serious consideration of all manufacturers who operate power driven machinery of any kind. The employer who feels that he has protected his workers with every possible means of reducing hazards, enjoys an inner feeling of satisfaction that will amply repay him for the efforts expended in this direction.

Randolph-Perkins Notes

George B. Massey, Vice-President, Randolph - Perkins Company, Engineers, and Associate Editor of PIT AND QUARRY is designing and supervising construction of a new plant for the Southern Phosphates Company, near Lakeland, Florida.

Randolph-Perkins Company, Engineers, are stripping 100,000 cubic yards of overburden from the quarries of the National Stone Company at Joliet, Ill. The work is being done by the hydraulic method. One hydraulic monitor is used for the excavation and a 10-inch dredge pump for removing the spoil.

Stephens-Adamson Equipment

AMONG the new developments of the year are two pieces of equipment brought out by Stephens-Adamson Mfg. Co. of Aurora, Illinois, namely, The Adel Excavator and the Monitor Car Puller.

The Adel Excavator, as illustrated in the company's literature, is a machine for cutting clay, shale, or soft ore banks and delivering a fine, uniform mixture from every stratum in the cut. This machine operates in a large semi-circle, and will plane a quarry edge from top to bottom, delivering 50 tons per hour and including in its work all the operations of loosening the material and loading and conveying it to the plant. This eliminates the old method of drilling holes, blasting and loading cars by steam shovels. It also does away with the lumpy, uneven texture of the material resulting from the old method, and substitutes a much finer and more uniform size.

This machine planes banks 30 to 50 feet in height. It is made in three models: No. 1, the Standard 50-ft. machine, cutting a 50-ft. bank on a 27-ft. cutting radius; No. 2, Extra Heavy machine, 50-ft. bank on a 28½ ft. radius; No. 3, The 30-ft. machine cutting a 30-ft. bank on a smaller cutting radius. The catalog describes in detail the construction of the excavator, with half-tones and diagramatic sketches.

The Monitor Safety Car Puller, for moving freight cars on the track siding, is driven by an electric motor enclosed in the machine housing. Two types are shown, the Horizontal Capstan Type, Style No. 999-A and the Vertical Capstan Type, Style No. 17-A. In both types the machine and motor are mounted on rigid cast iron bases, with rope pull.

Osgood Announces

The Osgood Company announces the appointment of Mr. C. J. Thompson as District Sales Manager in charge of the New York District with offices at 50 Church Street, New York City, effective December 1st.

Mr. Thompson has had wide experience in the excavating machinery and contracting field, and is ably qualified to look after the interests of the many friends and patrons of The Osgood Company.

Notable Developments in Churn Drill Dressing Machinery

By WILLIAM J. WALSH*

SINCE the big hole method of drilling and blasting first came into general use in quarries and open pit mines for the production of crushed stone and ore, the biggest problem operators have had to contend with involved the sharpening or dressing of the drill bits, which make the hole for placing the explosive cartridge.

It is a significant fact that in times of the greatest stress and hurry, many important factors entering into the cost of producing anything are often overlooked and neglected. In the production of stone there is nothing more important than the drilling of the holes for blasting, yet this is frequently given less consideration and attention by quarrymen than any other phase of quarry operations.

The results obtained in blasting, the efficiency of the steam shovels, crushers, operatives, etc., all depend on the results delivered by the drilling equipment used, so from that standpoint the drilling machine is the most valuable piece of equipment in the quarry, and is a most important factor in determining whether or not stone is being produced on a profitable basis.

One of the biggest problems involving the use of big blast hole or churn drills is the dressing or sharpening of the drill bits, which make the hole for placing the explosive charge. In many quarries and open pit mines using big drills, the hardness or abrasiveness of the rock is so great that it is necessary to change and redress the bits every few inches, so that when this operation is performed by hand the labor expense is necessarily very great, and in many cases runs the cost of production up so high that it is not profitable to use churn drills on this work.

Sharpening or dressing bits by hand—with forge and sledge, is not only an expensive operation, but is extremely hard work, and requires skill and experience on the part of the man at the forge. More bits are ruined through improper handling or treatment of the steel in dressing and tempering by hand than from any other cause.

Realizing the importance of this bit dressing problem, manufacturers of drilling machinery have for some time been giving careful thought and study to the development of a machine for sharpening bits mechanically, and considerable advancement has already been made along this line, as the accompanying illustrations will show.

In the design of this machine, dies of different shapes are provided to form special cutting edges on well drill bits—to suit different formation, which have a greater power of penetration than hand dressed bits, and will cut from 50 to 100 per cent faster, depending upon the physical properties and structure of the rock being drilled.

In producing these special bits, the manufacturers worked on the theory that a drill bit in order to prove successful in hard rock drilling must perform four necessary important functions, viz.:

1. Penetrate—The rock must be fractured or broken up in the bottom of the hole.
2. Crush—The fragments or rock chips must be ground or crushed to powder.
3. Ream—The wall of the hole must be reamed round and smooth as the drilling proceeds.
4. Mix—The powdered rock in the bottom of the hole must be mixed with water and held in suspension.

The bits were therefore designed with:

1. A sharp angle penetrating edge to break up the rock.
2. A large area of cutting face to grind it into powder.
3. A perfect reaming edge to keep the hole round and true.
4. Free water courses to mix the cuttings well for bailing out.

It is not difficult to understand why a bit of this design will cut faster than an ordinary hand dressed bit when these special features are taken

*Armstrong Manufacturing Company, Waterloo, Ia.

into consideration, but the increase in drilling speed is not the only advantage of the machine sharpened bits. In addition they—

1. Save time and labor:

No hand sledging whatever is required. The entire dressing operation is purely mechanical, rapid and accurate. Reduces time and labor of dressing bits from hours to minutes.

2. The steel is improved:

All the dressing strokes are in one direction. The steel is made more compact, and ruptures are eliminated, because there are no side blows, as in had dressing, to open the fibre or grain of the steel.

3. Are always exact gauge size:

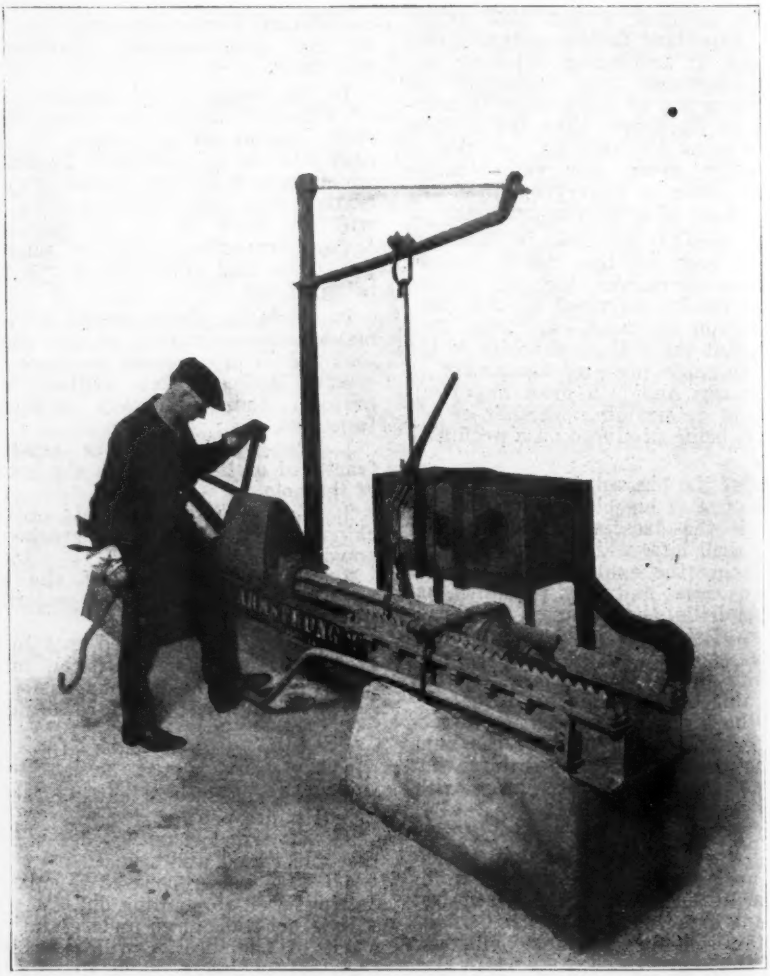
A special sizing ring and steel die on bit dressing machine keeps the cutting edge of bit of uniform size and shape at all times. There is no guess work as in the case of hand dressed bits.

4. Eliminates flat or crooked holes:

Eight-tenths of the periphery of the bit carries a reaming edge, which keeps the hole round and true, making flat or crooked holes impossible.

5. Steel takes better temper:

It is worked quickly and at just the right temperature before the forging heat is lost. In hand dressing the steel is worked at an uneven temperature and crystallization often results.



Bit Dressing Machine in Operation.

Recommended for extremely hard formations —drilling jobs ordinarily considered impossible.

This special bit is for use in drilling the ordinary straight run of solid rock. The Eagle Washer.

The machine itself is made entirely of steel and can be operated by a gasoline engine or electric motor, or directly off a line shaft if available. The maximum power to operate is 10 H.P. for a period of about fifteen seconds while the forging operation is in progress. Where there is no drop in the line voltage a 5 H.P. electric motor will handle the load for this short period and is being used on the majority of installations.

It is not necessary to buy special bits, as the patented cutting edge can be put on any ordinary well drill bits in a few minutes, and if kept dressed to exact gauge size, can be run until they become too short or too light to be of any use. The dresser is leased on very liberal terms, and with it goes the privilege of using the special cutting edges on any bits the lessee may already have. This plan makes it possible for the small operator as well as the large one to secure the advantages of the special machine sharpened bits at a very nominal cost.

The question will naturally arise: Where can this equipment be used profitably? Let us suppose, for instance, that a certain quarryman's operations are limited to the use of one drilling machine. The cost of operation would be approximately as follows:

Drill Operator	$5.00
Helper	3.00
Power	2.00
Depreciation	1.50
Interest on Investment	.50
Operating cost per day	$12.00

If the machine sharpened bits drill 50 per cent faster than hand sharpened bits, this means that the man operating only one drill will increase his profits $6.00 per day, or $1,800 if he operates 300 days in the year. If he operates six drills, say 250 days in a year, the extra footage will be worth $9,000.

It will consequently be seen, that this equipment can be used profitably by the small operator as well as the large one, although of course, the advantage is in favor of the large operator, as he can use the same bit dressing machine to dress bits for several machines, thereby enabling him to increase his drilling footage in proportion to the number of drills he operates, without any extra investment or expense.

With the ever increasing demand for greater economy in the production of stone, modern bit dressing machinery will undoubtedly soon become a permanent fixture in all quarries and open pit mines, large or small, where big blast hole drills are used, as a saving in drilling costs of 50 per cent will help in a large measure to effectively meet present day competition and show a satisfactory profit on the money invested.

Two damage suits, asking $5,000 each, were filed July 16 at Columbus against the Island Sand & Gravel Co., by the parents of two boys who were drowned in the Sciota River. The gravel company's reply denied responsibility for the deaths, charging the boys with trespassing on company property and carelessness in wading and swimming.

The National Slate Convention

SLATE AND ITS USES will be considered in all phases at the annual Slate Industry Conferences, held under the auspices of the National Slate Association at the Hotel Commodore, New York, on Monday and Tuesday, January 19th and 20th, 1925. These conferences are not restricted to members of the National Slate Association, but include all engaged in the production, sale or installation of slate.

In addition there will be special group meetings of each branch of the industry, the Annual Slate Industry Dinner, with its many entertaining features, and a complimentary luncheon tendered to the Slate trade by manufacturers and distributors of their equipment and supplies.

Registration and greeting of members and their guests at eleven o'clock Monday morning, January 19th, will be followed by a general luncheon of strictly informal character where George F. Barnard, of the Geo. A. Barnard Company, Roofing Contractors, of Worcester, Mass., and chief executive of the Monson Maine Slate Company, will voice a message of welcome in his capacity as President of the National Slate Association. Mr. Barnard's activities in both the production and contracting branches of the industry provide him with a wealth of experience and breadth of vision that make him an ideal president of an Association which includes among its members those active in all branches of the slate industry.

Immediately following luncheon six or more group meetings of the various branches of the industry will convene, each providing a platform for a discussion of their own particular problems and interest, including:

A—Roofing and Milled Slate Producers

B—Dealers and Jobbers

C—Crushed and Ground Slate Producers

D—Slate Roofing Contractors

E—Slate Setting Contractors

F—Roofing and Milled Slate Salesmen.

At four o'clock, the electrical switchboard and panelboard manufacturers will join the Group A Conference for a discussion to correct misunderstandings, adjust complaints, arrive at some standardized basis of measurements, eliminate wastage and make a general clearance of the problems which have characterized conditions in the marketing of electrical slate.

The annual dinner at 6 o'clock on Monday will alone be worth the journey to New York, for, in addition to the gustatorial feast, a program of fun and frolic is in course of preparation that will long remain a fond memory with every slate man who is lucky enough to have his feet under the festive board. Not alone that, the announcement of awards for outstanding achievements in many branches of activity in the industry will provide many surprises and much mirth, to say nothing of the solid facts and ideas presented for the advancement of slate in all its varied phases. These awards will recognize the highest achievement in advertising, selling, displays at building shows, new uses and other features, too numerous to mention.

Of course, every guest will be presented with an appropriate souvenir and will have an opportunity to join the theatre party that will provide a fitting end to a pleasing and profitable day.

Tuesday morning will be devoted to a resumption of the group sessions and the Annual Business Meeting, merging into a general assembly at 11:30 when recommendations by the different groups will be made to the Association of their findings in separate session, and acted on, as to what can be done for each branch of the industry and the industry as a whole toward improving conditions. A novel feature of this meeting will be the first showing of the new "Slate Movie" planned and developed by the Association.

At one o'clock the entire convention will be guests at the complimentary luncheon tendered the Slate trade by the concerns from whom they purchase their equipment and supplies. The closing session of the convention immediately following will take up the question of how to improve methods of production and distribution. Discussion on this vital subject will be shared by both the concerns furnishing equipment and the practical slate men who use it; who will meet on a common ground and develop a common program of improvement for themselves and the industry at large.

A New Structural Gypsum

THE United States Gypsum Company is introducing to members of the building professions Structolite, a new adaptation of structural gypsum, to be mixed with an aggregate and poured to form the main walls and partitions of bungalows or two-story dwellings. It also has been used for bearing walls in one-story factory buildings, and is recommended for curtain, fire-stop and other walls in heavy-type industrial and commercial buildings where the principal loads are supported by steel or Portland Cement concrete.

The significance of this development, as conceived by the manufacturers, is that it makes highly insulated, fire-proof construction available for residences at a cost that compares favorably with that of ordinary frame construction. With walls and floors adapted from the numerous poured and pre-cast systems which the Gypsum Company has been erecting for the last 25 years, it now is possible to erect an all-gypsum house with all principal parts incombustible.

Character of the Material

Among the advantages which, the manufacturers submit, Structolite offers to builders are the following, accompanied in each case by the facts that justify the claim:

1. Fireproofing. Fire and water tests were conducted at the testing laboratories of the Department of Civil Engineering, Columbia University, December 19, 1923. Two test panels 3 inches thick, 9 feet wide and 14 feet long were erected. During the first 15 minutes temperature was maintained between 1,300° and 1,452° F. It then was raised to 1,735° F., 27 minutes after the fire started, and was maintained at an average of 1,707° F. for the remainder of one hour.

Average deflection at the end of the test was .21 inches outward, or away from the fire. Average deflection 20 hours after the test was .204 inches outward. One minute after the fire was extinguished, water from a 1⅛ nozzle was directed against the fired sides of the two panels, with a pressure of 30 pounds, from a distance of about 20 feet, for about 3 minutes. These are the conditions which brick, concrete and similar constructions must meet to be approved as fireproof under the Building Code of the City of New York.

William J. Krefeld, engineer of tests, and Albin H. Beyer, director of testing, commented on the results of this test as follows:

"There was no visible sign on the exterior surface of either partition that they had gone through a one hour fire and water test . . . On the side of each partition exposed to the fire, the Structolite binder or cementing material had been calcined for a considerable depth—in places, probably from an inch to an inch and a half. When the water was applied, this calcined material was washed off and the surface appeared to be pitted."

Following this test, Structolite was approved as fireproof construction in the boroughs of Manhattan, the Bronx, Richmond and Brooklyn. The Department of Labor of the State of New York on March 28, 1924, issued approval of this construction as conforming to the requirements and specifications of Industrial Code Rule 512.

2. Thermal insulation. The test-report states that the temperature on the outside of the panels never exceeded 210° F. while the inner surfaces were subjected to as much as 1,817° F. It is to be borne in mind that these panels were only 3 inches thick while the recommended Structolite construction is from 4 to 10 inches thick.

3. Bearing strength. Heretofore, it has been impracticable to use gypsum for the bearing parts of a construction because it has lacked density necessary to give it the required compression strength. Structolite is a form of gypsum especially ground and chemically treated to give it the necessary density. Its compression strength when mixed neat is 2,500 pounds per square inch, as against the 800 pounds of the gypsum used in other poured and pre-cast constructions. When mixed with any of the standard aggregates—the manufacturer's recommendation being 1 part, by volume, of sand and 3 parts of clean well graded cinders to 1½ parts of Structolite—it develops an ultimate

compression strength of at least 500 pounds per square inch, which permits of a factor of safety of 10 in ordinary residential design.

Compression tests were conducted at Columbia University in November, 1924 (Report No. 1446, Dec. 1, 1924). Tested cylinders varied in height from 12 to 12.5 inches; in diameter, from 5.9 to 6.06 inches; in area, from 27.34 to 28.84 square inches. Results are summarized in these tables:

Mix, parts of each material	Structolite, 1½ Cinders, 3 Sand, 1		Structolite, 1½ Crushed stone, 3 Sand, 1		Structolite, 1½ Gravel, 3 Sand, 1	
Maximum load, lbs.	19600	20550	21820	21500	13220	19880
Unit stress, lbs. per square inch	715	750	800	785	475	715
Average lbs. per square inch	733		798		595	

Mix parts of each material	Structolite, 1 Cinders, 2		Structolite, 1 Crushed stone, 2		Structolite, 1 Gravel, 2	
Maximum load lbs..	31860	35430	22950	25730	22200	21150
Unit stress, lgs per square inch	1130	1230	825	925	800	760
Average lbs. per square inch	1180		875		780	

4. Sound insulation. Tests conducted at the Lewis Institute, Chicago, have established that gypsum partitions are 60 per cent more effective as non-conductors of sound than clay tile partitions.

5. Light weight. Structolite weighs only 85 pounds per cubic foot while the weight of Portland cement concrete is 150 pounds. This fact means considerable savings in designing the other parts of the structure.

6. Quick set and consequently rapid erection. Whereas, other concrete takes days to harden so that the forms can be removed, unretarded Structolite sets in 15 minutes. This set is retarded at the factory to meet job-requirements. In the usual construction it sets in 30 minutes. By that time the material acquires 60 per cent of its ultimate strength and the forms can be removed. Owing to these facts, it is economical to use metal forms with Structolite. The rapid re-use of these made possible by the quick setting of the material minimizes the investment tied up in forms and expedites construction.

7. Adaptability. Any floor-plan, any architectural treatment and virtually any roof- and floor-design is possible with this material. Poured and pre-cast floors and roofs, which the United States Gypsum Company has been designing for industrial and commercial buildings for 25 years, may be adapted to make the residence entirely fireproof. Or these parts of the building may be of slow-burning frame or ordinary frame construction. Since gypsum is not a hydraulic cement, Structolite is not recommended for exterior surfaces. The manufacturer recommends that exteriors be of stucco, frame or brick veneer.

Methods of Handling

In the typical Structolite house the foundation, of masonry or cement, is carried at least 18 inches above the grade-line to prevent water-absorption, and its top surface is covered with a sheet of 40-pound roofing felt or with R.I.W. or an equivalent damp-proofing compound.

One course of forms is adjusted around two or more sides. Window-frames and door bucks are set in place while the forms are being adjusted. All corners and openings are reinforced by steel rods or steel web fabric. In bungalows or other one-story constructions, the outside walls are at least 6 inches thick; in two-story buildings, 8 inches or more. Partitions are 3 or 4 inches thick and closet walls, 1¾ or 2 inches.

Mixing may be done either by hand or in a drum type batch concrete mixer, care being exercised in the latter case to keep the drum clear so that no crystallized particles of gypsum accelerate the set of the bulk of the material. All walls and partitions are carried up simultaneously, the forms from the first course being removable by the time the second course is poured.

It is recommended that ⅜ inch of plaster be applied directly to the

Structolite frame to provide the interior finish. This eliminates the cost and fire hazard of lath or furring. The outside of the frame should be covered, as soon as the superficial moisture has dried out, with a dampproofing compound. Then it is ready for the exterior finish.

In case this is to be stucco, the wall is scratched and then a 2 inch by 2 inch electrically welded wire fabric is stapled on and covered with ¾ inch of approved stucco. If the outer finish is to be of drop siding or other wood lumber, vertical furring strips are nailed directly to the wall and the lumber, to these. If a brick veneer is desired, anchors may be driven into the wall or cast in place, to be imbedded in the brick course.

Past Uses of Structolite

Although now receiving its first introduction to the building industry in this form, Structolite has been used successfully in reinforced roof construction for about eight years. Its first use as a binding material for aggregates was three years ago when garages and service stations were built of it.

Later it was used in bungalow-type homes and then in two-story dwellings. In each case the material met every condition presented by that type of construction. It also has been used for bearing walls in one-story factory buildings where there are no heavy concentrated loads.

Eleven two-story residences of Structolite are being erected in Yonkers, N. Y., having been designed by Pettit & Ferris, Architects, of New York City. In the first unit of twenty dwellings in the City of Cohoes, N. Y., municipal building projects, ten Structolite houses are under erection and five more are contemplated. Other constructions are either contemplated or in various stages of progress at Garden City, Long Island, Fort Dodge, Ia.; Mt. Vernon, N. Y., and other places.

Structolite is shipped in 100-pound jute or 80-pound paper containers. It is produced by the United States Gypsum Company at Fort Dodge, Ia.; Gypsum, O.; Oakfield and New Brighton, N. Y., and Loveland, Colo. Eventually it will be manufactured at several other plants of the company.

Specifications for the use of the material and further information concerning it may be had from the fireproofing department of the company at its headquarters, 205 West Monroe street, Chicago.

"Domestic" Improvements

AN ADDED feature to the "DOMESTIC" Heavy Duty Hoist Unit is the adoption of a silent chain drive. This method of transmitting power from engine to hoist very materially reduces frictional losses as sustained by use of gear drive and increases the general efficiency of the unit. These features, in addition to the positive screw thrust apparatus, which is standard with all "DOMESTIC" medium and heavy duty hoists, makes an outfit that is ideal in every respect.

"Keeping abreast of the times" is the slogan used in the manufacture of the "Domestic" line of portable air compressor units. The principle of design in utilizing power generated by two engine cylinders for each compressor cylinder is maintained throughout the line. One crankshaft is used to drive both engine and compressor cylinders. Aluminum pistons and light weight connecting rods have been adopted as standard, thus giving a well balanced outfit with minimum weight.

The Domestic Engine and Pump Company of Shippensburg, Pennsylvania, have also developed a new double acting trench force pump unit. This outfit has a wide variation of uses, and will handle water containing a large percentage of foreign matter such as is found in trenches, manholes, sewers, quarries, mines, etc. The pump can be furnished with either a one-cylinder or two-cylinder gasoline engine, or can be geared for electric motor drive. It was designed to meet the demand for a unit of large capacity that will handle dirty water and discharge it through pipe or hose lines to suitable place for disposal. It has the maximum capacity with minimum of bulk and weight and will discharge to high levels or through long horizontal lines without sloppage around the pump. It is especially suited for pumping out flooded foundations, boat bilges, trenches, sewers, all types of excavations, etc.

Prosperity in Texas

Much Gravel Being Shipped for Highways and Railroad Ballasting. Red "Ore" Gravel Is Coming Into Favor

By Our Dallas, Tex., Correspondent

PROSPERITY continues to rule for sand and gravel dealers in Texas, as building operations go on apace and road construction and paving contracts are being awarded almost daily. Texas is in the midst of a road building and street paving campaign such as has never before been seen in this state, and large quantities of sand, gravel and cement are being used in these contracts.

In Dallas the J. Fred Smith Gravel Company is shipping large quantities of the pit-run gravel of the proper mix for concrete work. The gravel furnished by this company is being used in building much of the concrete highway in Texas, as it is not necessary to screen the gravel or to mix more sand. All that is necessary is to mix cement and water and spread the mix on the highway. Some of the best highways in Texas were built from this mixture of sand and gravel just as it was shipped from the pit, where it was loaded on cars with steam shovels and drag lines.

Much of this gravel is also being used for road ballasting by the railway companies, and the Dallas concern ships much of its product to the railway companies.

East Texas railways are using the red gravel, in which there is a large iron ore content, found in East Texas. The outcropping of veins of iron ore are numerous, and it has been found that this material affords a most excellent road ballast. It is also being extensively used for highway construction and there is a growing industry in working these ore beds as gravel beds are worked about Dallas.

The Santa Fe is ballasting its Texas lines with crushed stone and has installed a mammoth rock crusher near Brownwood. Rock is taken from a mountain near Brownwood on which the quarry and rock crushed has been installed, crushed and shipped to all parts of this company's lines in Texas. An industry of considerable importance is developing at Brownwood.

Prices for sand and gravel in Dallas remain stationary, and the demand for these products continues strong. The city's extensive street paving program, involving an expenditure of something like $2,500,000 is well under way, and much of the sand and gravel used in this program is being purchased from Dallas firms.

Building operations also continue unabated. Work has begun on the foundation of the new 18-story Baker Hotel, and the framework of the 18-story Republic National Bank Building is up to the twelfth story. Contracts have been awarded for several other large buildings, and still others are in contemplation.

Voting of bonds for highway construction and awarding of highway contracts in all parts of the state indicate a period of unusual activity in road building.

Precinct No. 3 in Madison County has voted $75,000 in bonds for building graveled roads about Normangee. Leon County, adjoining Normangee, has already voted bonds and the contracts for about 35 miles of graveled highways are to be awarded soon.

Jack County, the county seat of which is Jacksboro, will award contracts this month for nearly $100,000 worth of highway construction, including 17 miles of graded highway and 51 miles of sledged stone and macadam surfacing. Another state highway is being located in Jack County and about $100,00 will be expended on its construction.

Contracts have just been awarded by the City of Marshall, Texas, for paving ten streets or sections of streets in the city. Approximately $150,000 will be spent, and most of the pavement laid will be concrete. The city is to pay for one-third of the paving and the property owners two-thirds.

County Engineer W. M. Fooshee of Lamar County, at Paris, Texas is advertising for bids for the construction of 5½ miles of concrete highway in Lamar County.

Tyler, Texas, will issue $150,000 in bonds for paving of the city. Property owners will pay for two-thirds of the street paving laid, which will give the city $450,000 worth of paving, and work is to start as soon as material can be assembled.

Advancement in the Quarry Business

Written Expressly for PIT AND QUARRY by R. N. VAN WINKLE.

THERE is an old expression which all of us have doubtless heard many times that, "If our foresight was as good as our hind sight everything would have been all right," so when I was asked to write an article for the Engineering and Review Number by the editor, dealing with prospects of costs, prices and growth of the crushed stone industry for the year 1925 and what it holds for the quarry, I hesitated, feeling that prophesying the future, except by means of business barometers, the law of averages and the trend of the times, is just as easy for one man as it is for another and to my notion is fair sport for anyone, for after all it's really a matter of one man's guess being as good as another.

Experience gained from the past is one of our greatest business assets, and the man who is rich in experience is as a general rule the one likely to undertake and try out new ideas and experiments for the future good or betterment of his chosen line of endeavor. To a student of the crushed stone industry many, many things can be learned from past experience, for the industry has been almost wholly revolutionized in the past twenty years; steam shovels have supplanted hand laborers, well drills have come into common use, gasoline locomotives have proven themselves as dependable as the old reliable quarry mule and many near wonders have happened that at one time would seem as improbable and as impossible to us as sitting in our own home, today, listening to a concert a thousand miles away.

The past then in the crushed stone industry is a matter of tangible records of achievements and advancements, a matter of well earned experience, but the future and what it holds or offers by reason of its uncertainty is unquestionably a very vital and absorbing question in the minds of most quarrymen, so it is the purpose of this article to suggest ideas that have come to the writer's mind from time to time that in his judgment would be beneficial to the advancement and betterment of the crushed stone industry.

Can engineering principles be applied successfully to quarrying? There is a growing tendency on the part of the quarryman to use engineering principles, technical advice and information in the operation and management of his business, and while this practice is in reality just in its infancy, it is absolutely essential to the stone industry if the industry is going to keep abreast of the times and prosper. Technical information is not only essential in operating matters, but technical information never hurt the best salesman that ever sold. Why should Westinghouse, General Electric, General Motors and other such concerns maintain a staff of seasoned technical brains and sales and apprentice courses of study? Because they have come to realize "The World Do Move," and if they are not properly equipped to move with it and keep abreast of progress, it may move them aside in a way they won't like. The advice of a technically trained, unbiased, seasoned and experienced engineer helps others, it will you.

Consolidations of small quarry operations into sizable companies are economic necessities for the future of the industry and offer great possibilities. During the last fifty years, almost continuously, small unprofitable businesses have been merged or consolidated and been made commercial successes. In most instances order has been brought out of chaos, operating losses have been turned into profits, over head reduced, credit restored, service bettered, quality of products improved and cost to the using and consuming public reduced, much of which has been attributed to consolidation. Do not understand or get me wrong, that I recommend consolidation as a panacea, but I cannot help but be impressed by the benefits which can come therefrom and feel that if some of the quarrymen would give thought to consolidation, instead of competition, surprising results could and would be accomplished. There are now a few large quarry concerns personally known to the writer that have been formed by consolidating a number of operations and in every instance success has ultimately followed.

We are living in an age of bureaus, institutes, and associations. The time has passed long since when a man,

single handed, could go out and conquer the world or even conquer his own business world; the age "Lone Wolf" is gone, and for the quarryman his state stone club, or state stone association, together with the National Association will, if they have not already become so, in the future be absolute essentials to the successful handling of his business. Our good friend, Put Sandles says, "An Association is the best medicine in the world to cure the cut throat disease that affects competition." It is more than that, it is the only means, as I see it, to bring about co-operation in its broadest sense, leadership, modern methods and practices that will gain for the quarry industry its proper place in the minds of the banker, the consumer, the engineer and the public at large, and is the means of bringing to the quarry operator and owner a new era—a feeling of pride instead of regret in being engaged in this basic industry. I contend that co-operation and the willingness to support trade associations, bureaus, or whatever name you may call them, are essential to the future of the crushed stone industry and are things to which every successful operator must belong and give his time willingly.

New occasions demand new duties. The products of the quarry and pits as produced five years ago, yes even two years ago, are not acceptable today, and the future success of the quarryman and his choseen industry rests entirely with the ability and willingness on the part of the producer to meet the demands for better aggregates and assume the new duties which, as a producer he must of necessity shoulder. The old take it or leave it attitude must be discarded and in its place should be a desire on the part of every producer to enlighten himself as to the best methods and practices of putting on the market the product as specified by the engineer, the architect or the contractor and by this means show them we are ready and willing to co-operate to the limit in establishing the crushed stone industry on a higher plane. Future markets will demand better graded and cleaner aggregates, and unless you as an operator are willing to co-operate in producing such aggregates your future is quite questionable, if not questionable, at least a hard and tough one.

While dealing in futures it is well to consider what effect, if any, advertising will have on the future of the quarry business. The writer's mind is made up, that appropriate signs advantageously placed on the property or operations of quarries adjacent to main highways, railroads or electric lines are excellent. These signs can be illuminated and in that way become silent salesmen twenty-four hours of the day. Mouth to mouth advertising should be encouraged, as it is one of the great forms of advertising, but do not lose sight of the fact that a satisfied customer is the best advertiser. It was advertising we know that put Ivory Soap in the bath tubs of the nations. It is advertising that makes babies cry for Castoria, and it is advertising that induces a man to walk a mile for a Camel, and while advertising in the above forms can hardly be applied to the quarry industry, the right kind of advertising could be advantageously used I believe in educating customers in the use of products that have merit.

We all at times worry, and unduly, about matters over which we have no possible control and by so doing make mountains out of mole hills. For instance, about this time every year we in the quarry business stew and fret over business prospects for the ensuing year when, if we would but stop and reason we know that our government is absolutely sound, money is plentiful, crops have been good and that prospects are bright, not alone for our industry, but for practically every basic industry. Instead of worrying about future business it often appears to me that it would be sound logic to first put our own house in order by finding leaks and misfits which we can unquestionably control ourselves, and to improve our business methods by using the experience of others.

The quarrymen as a whole I fear are sometimes too much absorbed in increasing output, making money and handling routine matters of daily business to profit by the things that are developed in other lines of industry and business, which are directly applicable to his own line. By too close confinement to matters directly in hand, a man may go stale and lose all sense of proportion, but getting away into new surroundings, new environments and seeing what others are accomplishing in different lines, is a stimulant worthy of taking when needed and as often as needed.

Sand and Gravel Pumping Plants in 1924

Written Expressly for PIT and QUARRY, by V. J. MILKOWSKI*

THE year 1924 had its full share of developments and improvements in the field of sand and gravel dredging plants which, while of small significance when considered individually, when taken together measure a considerable step in advance. The first in line of new developments is the application of dredging pumps to small and inexpensive plants. The mention of a sand and gravel pumping plant generally conveys an idea of a large, elaborate dredging plant and of an equally elaborate screening and loading plant. This, however, is just the opposite from being true of some of the small plants that have been put in operation during the past year.

Figure 1 is a fair illustration of a plant of that type. A dredging pump, which is 6 inches, is located in the small shanty in the center. The suction is operated from the float or pontoon in the lower lefthand corner. The screening plant shown in the rear is equipped with a vibrating screen and two sand settling boxes. The plant is electrically operated throughout and requires three men to look after the entire operation, including the office. The dredging pump is directly connected to a 50 H. P motor and delivers the material direct to the top of the screening plant. The output of this plant is one car or approximately 50 tons per hour, and the material produced is first-class washed and screened material, which will meet the most rigid specifications. The finished material is loaded into cars or trucks by gravity.

Figure 2 shows the entire operating force and, judging by their expressions, their lot must be happier than that of most of the sand and gravel producers.

Figures 3 and 4 illustrate another small inexpensive dredging plant, Figure 3 showing the dredge itself, while Figure 4 shows the screening and loading plant. This plant is operated by gasoline engines and the pump, which is 6 inches, is directly

*Engineer—Morris Machine Works.

Fig. 1—A Typical Small Pumping Plant.

Fig. 2—From Left, W. Sunderland, F. W. Sterrett and W. D. Smith.

connected to the engine. The dredge hull is 14 feet by 24 feet. The material is delivered to the screening plant through the pipe shown to the left in Figure 4. The material first passes to a revolving screen where the gravel is taken out, and the sand and water flow into two sand settling boxes where the sand is dewatered. The finished material is loaded into the loading bins by means of an elevator, from where it is loaded into trucks by gravity. One gasoline engine operates the entire screening and loading plant. This plant is likewise operated by three men, and can produce one car of finished material per hour.

The foregoing examples point out the possiblities for application of

Fig. 3—An Inexpensive Dredging Layout.

pumps in small temporary plants along river banks, etc., wherever suitable material may be available.

The second marked step in advance during the past year is the improvement in the dredging pumps themselves. Until now, dredging pumps have been but crude machines which wore out rapidly and which dropped off in efficiency very rapidly when pumping sharp material against high heads. After a series of tests and observations conducted by our organization, a line of pumps has been developed in which the flow of material is confined to its proper channel, and in this way most of the leakage and churning of material within the pump is eliminated. This leakage and churning in the old style dredging pump were, of course, the principal causes for rapid wear and for the waste of power within the pump.

The third development deserving mention is the application of a revolving cutter to sand and dredging plants during the past year. While banks of sand and gravel cave in readily and dredges with plain suction or with a jet agitator on the suction are used principally, the use of a revolving cutter has been found to be justified on some of the larger sand and gravel pumping installations. This makes the feeding of the solids into the pump more uniform and excludes the oversized material from the suction. In addition to that, a cutter breaks up readily pieces of clay or cemented material such as are commonly met with in sand and gravel deposits. To function properly in a sand and gravel deposit, the cutter and the cutter ladder must be designed especially heavy, and the cutter must be made in the form of a cage in order to exclude the oversized material from the suction intake.

Among the installations of the past year deserving particular note is a 10 inch oil engine driven sand and gravel dredging plant of the Kirkpatrick Sand & Cement Company of Montgomery, Ala. The dredge is equipped with a plain suction, and the entire dredge is operated with one diesel oil engine. The dredging pump is driven by belt from a friction clutch pulley on the engine, while the auxiliaries, that is, the hoist, service pump, compressor and a small lighting generator, are driven from another countershaft, this countershaft being driven from another pulley on the engine. This arrangement permits of shutting down the dredging pump without shutting down the engine or the auxiliaries. This type of installation is particularly adapted for plants operating against a high head where electric current cannot be obtained readily.

The foregoing covers the high spots in the field of sand and gravel dredging installations during the year of 1924. It is to be hoped that similar advances may be made in this field during 1925.

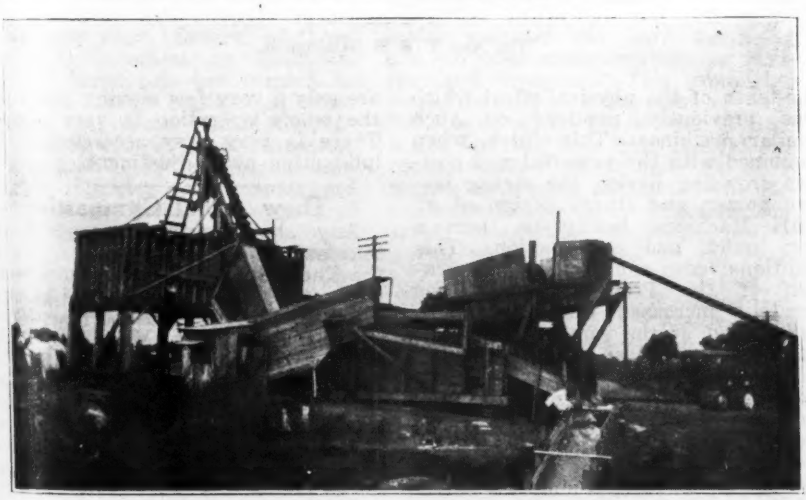


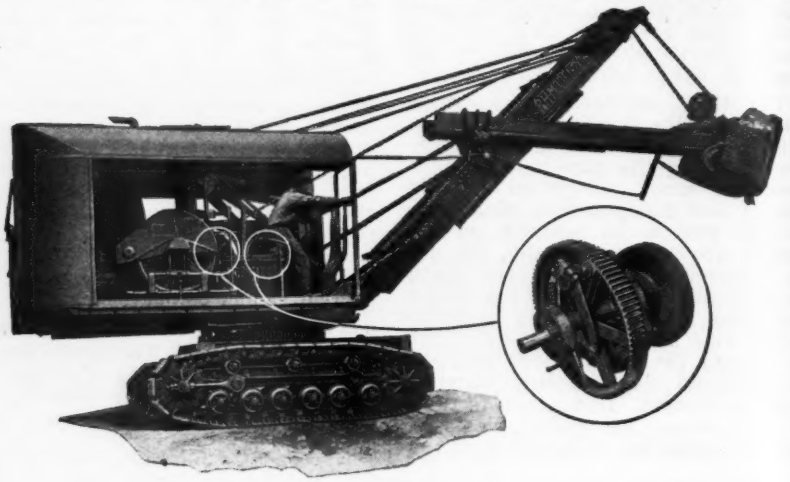
Fig. 4—An Economical Screening Plant.

New Development on Excavating Machinery

THE Pawling & Harnischfeger Company of Milwaukee, Wisconsin, have recently developed and made practical application of a new clutch control device, operated by the power of the engine and adapted for use on the P&H Excavators. This new device, although simple in construction and action, will undoubtedly be a big factor in the ever rapid development of the gasoline and electric powered excavators.

The perfection of this new device has enabled the operator of the P&H Machines to control movements of the machines with approximately one-tenth of the physical effort which was previously required on such similar machines. This clutch, when combined with the powerful and positive crowding device, the strong motive power, and sturdy design of all P&H Machines, has given them a very quick and easy action. This additional ease and facility of operation of the P&H, naturally, has greately increased the total daily output and at the same time by reducing the physical effort necessary has enabled the operators to give more careful attention to the care of the machinery, increasing its life and productive usefulness.

This device, as shown in the accompanying picture, is simply a small auxiliary brake with attachments which causes the power of the motor to operate the main drum clutches. When the spur gear is rotating, the drum clutch, clutch operating arm and drum all rotate with it. The auxiliary clutch band is stationary, the dead end being fastened to the machine frame and the other end to the operating lever. When the operator pulls the lever towards him, the auxiliary clutch band is tightened about its drum, retarding the rotation until the clutch operating arm has been rotated sufficiently to cause the main clutch to grip the drum. The average pull required to operate this control device is about 4½ lbs. There are only a very few moving parts and the whole operation is very simple. There is very easy accessibility for lubrication and adjustment.



The New P & H Attachment.

Thew Aerial Gymnastics

Any shovel operator wishing to take steering lessons should apply to the Thew Shovel Company of Lorain, Ohio. A Thew Gasoline shovel belonging to the Astoria Crushed Rock Company at Cathlamet, Wis., found the only way it could reach its place of operations—extension work on a logging railroad—was over a high one-track trestle, so narrow that the shovel treads projected over each side. This trifle could not stop the engineer, for he piloted his shovel safely across and ambled on his way as though it were an every day occurrence.

Reviewing the Year at Memphis

Activities During the Year 1924 in Tennessee, Mississippi and Missouri in Sand, Gravel and Clay Fields

By Our Memphis, Tenn., Correspondent

DECEMBER finds the sand, gravel and clay pit people winding up a year of varying activity, for the most part a very busy and satisfactory year. The autumn season has been bright and open. Conditions on the river and the situation with respect to cars is satisfactory. A heavy downpour of rain that usually marks December has started and during the next three months of the usual winter season, despite a large amount of road work already done an active period seems to be in store.

Railroad ballast demands in some parts of this section have been good, especially in Kentucky. The building trades have been abnormally good throughout the year on both sand and crushed stone products, and the crest seems to have been reached, though quite a few structures and considerable paving is yet under plan for the coming months of 1925. It would appear that warehouse, residential work and commercial structures will be the biggest line of building activity next year at Memphis. In 1924 it has been sky-scrapers, hotels, churches, schools and residences, also several large industrials.

The clay and pottery interests in Tennessee cities and towns have enjoyed a busy year. Several of these interests have offices in Memphis. Numerous large pits are located in Henry and Carroll counties in West Tennessee and some around Chattanooga and Erwin, in East Tennessee. The glass, crockery and queensware wholesale interests at Memphis are representative. R. D. Goodwyn, head of the Goodwyn Crockery Co., wholesalers at Memphis, and formerly for a great many years active with the Memphis Queensware Co., died in Memphis in November. He was a life long resident of this section and most highly regarded and well known in the trade.

The brick trades formed an association in Nashville during November. The brick plants have had a large business both at Memphis and Nashville and in the smaller cities some new ones are being launched.

The wholesale cement and building material trades at Memphis are in some instances adding minor improvements at their yards and plants, most of which are already nearing completion.

The road building work in Tennessee, Mississippi and Missouri for 1925 is full of promise. In many counties of the first state, at three different lettings in 1924, some ten million dollars in contracts have been let but the work is moving slowly and while some of it has been completed a very considerable portion will be under way next year. In Mississippi, Hinds county, Jackson is active in a road building plan; the counties of the gulf coast section are making great progress and the Delta section from the Tennessee line towards Vicksburg are doing more or less road building.

A large highway proposition was voted on in Missouri on November 4. It was announced by the promoters that a $15,000,000 bond issue was needed to complete the good roads system. On October 1, 1924 there had been completed 1,390 miles of state road, graded, bridged and hard surfaced. There were 1,650 miles more graded and bridged and ready for hard surfacing, and 882 miles under contract for hard surfacing and 886 miles under contract for grading and bridging. This completed work represents a payment of $40,000,000 of which $15,000,000 is from bonds and the rest from federal aid, county bonds spent on state roads, together with state aid, under the McCullough-Morgan law. The total contracts let amounted to $55,000,000.

The biennial session of the Tennessee General Assembly meets at Nashville in January, the session lasting seventy days, with a recess during the session. Many problems confronting the highway department and another important one concerning the creation of a large public park on a great acreage in the Great Smoky Mountains, in the counties of Sevier and Blount, will come before the body. Tennessee has under way her $2,000,000 Capitol Annex. This is being built

of stone by the A. J. Krebs Co., of Atlanta, Ga., and various sub-contractors. Good progress has been made in this work which has been going on for some time.

Touching the matter of pit and quarry operation in the Memphis section, PIT AND QUARRY'S correspondent today called on the leading firms in Memphis. While some of them report good activities, others report the dull season of the year at hand.

The Memphis Stone and Gravel Co., at 1630-33 Exchange Bldg., Memphis, was seen. C. D. Smith and associates head this firm. Their quarries and gravel pits at Iuka, Miss., Camden, Tenn., and Gravel Switch, Ky., are all active. The last three months have been productive of good trade both in road building material and railroad ballast, shipments of which have been going forward with good regularity.

The Allen Gravel Company, fourth floor, Exchange Building Memphis, was seen. They are large shippers of Tishomingo gravel, with pits in the northern part of Mississippi. Chas. H. Miller, of Memphis and Little Rock is actively at the head of this business. The fame of Tishomingo cement gravel is widely known and in the building and road building trades they have had a good year, though in December the shipments have not been so numerous due to weather conditions and the progress of road work. This firm and others seen, state that much of the actual road work at present is in grading, excavation, drainage, etc., and that the surfacing gravel or concrete for the post part is to follow later. However during the last lap of 1924 quite a few hard-surfaced roads in this section started some months ago have been successfully completed.

The Camden Gravel Company on the twelfth floor of the Cotton Exchange Bldg., Memphis, was also visited. J. C. Ridley is manager of this office. The gravel pits are located in Benton County, Tenn., around Camden. They are shipping spasmodically, and operating two or three days a week, operations being less active than in the autumn.

With initial road work planned and in some instances started, they look to see a good activity before the spring of 1925. Camden gravel, too, is widely known as a road building material and is shipped extensively.

The Batesville Gravel and Material Company who have recently moved their offices to 1206-1207 Union and Planters Bank Building, a new skyscraper at the corner of Madison and Front Street, opposite the Custom House, have been large operators in Mississippi gravel in the section about Batesville for a number of years. Mr. Duquesnay is manager of the Memphis office. Elliott Lang, for a long time connected with this company recently died, also Mr. Darnell of the organization. Their pit and quarry interests have enjoyed more or less activity throughout the year and are planning a full line of operations for the coming year.

The exports of hydraulic cement in September, 1924, were 69,470 barrels, valued at $206,921, of which there was sent to Cuba, 36,071 barrels; to the other West Indies, 2,995 barrels; South America, 15,658 barrels; Mexico, 8,954 barrels; Central America, 2,687 barrels; Canada, 512 barrels; and to other countries, 2,593 barrels. These exports are exclusive of shipments to the following possessions: Alaska, 95 barrels; Hawaii, 1,446 barrels; Porto Rico, 6,580 barrels.

The statistics of imports and exports of hydraulic cement in October 1924, are not available.

Imports and Exports of hydraulic cement, by months, in 1923 and 1924. in barrels

Month	Imports		Exports	
	1923	1924	1923	1924
January	71,686	153,732	74,169	88,586
February	20,529	162,930	88,531	62,606
March	66,521	160,517	98,861	91,224
April	76,899	148,138	85,662	83,200
May	88,480	161,304	103,634	88,850
June	111,559	196,655	77,203	74,064
July	286,106	109,098	82,774	60,139
August	324,008	192,634	73,201	85,883
September	215,785	134,245	77,121	69,470
October	172,051	.....	74,302	.....
November	140,590	.....	85,743	.....
December	104,422	.....	80,487	.....
	1,678,636	.....	1,001,688	.....

Ball and Tube Mill Operation Improvements

THE use of balls, slugs and other metallic grinding media, together with the greater efficiency obtained by the use of large diameter ball and tube mills has reduced grinding costs.

The fact remains, however, that neither of these machines is the most economical finish grinder and the power required is great in proportion to the work accomplished.

A tube mill which will grind two tons per hour to 95 per cent through 200 mesh will grind six or eight tons to a fineness of 50 per cent. through 200 mesh; the product in the latter cast containing about twice as much 200 mesh material.

Most mill operators are aware of this fact but until a few years ago no practical separating device was available and closed circuit grinding, which is today the standard practice in many industries, was almost unknown.

Closed circuit grinding increases mill production from 25 to 50 per cent, or more and any existing tube or ball mill can easily be arranged to operate on this system as the only additional equipment necessary is a suitable separator, an elevator and a pipe to return the oversize to the feed end of the mill.

In operating such a unit, the material is forced rapidly through the mill, the product separated and the oversize returned to the mill for regrinding, together with a sufficient amount of fresh feed to replace the fines removed.

In closed circuit grinding two important facts must be considered; the first, the circulating load must be great enough to force the material rapidly through the mill and cause a positive discharge; attempting to hold the material in the mill until it is nearly ground defeats the very purpose of this system which required a rapid discharge and outside separation.

The second, and most important factor, is proper separation of the partially ground material, and this necessitates a machine in which the sizing is positively and automatically controlled at any predetermined fineness irrespective of fluctuations in speed or rate of feed. For cement work the separator should be capable of handling abrasive substances without appreciable wear; require little power, no attention, and it should be designed to operate continuously for months without a shutdown for any cause whatever.

About four years ago a new type of separator was placed on the market, in which sizing is accomplished by centrifugal force and this machine has unquestionably solved the problem of grinding mill efficiency.

This separator requires no blowers, cyclones, dust collectors or auxiliary apparatus and can be used with any type of grinding mill without changing the latter in any way.

The centrifugal separator can be positively adjusted for any given mesh of product and when once set for any desired fineness produces an absolutely uniform product irrespective of any variations in speed or rate of feed.

As it operates at slow speed there is practically no wear. No coarse material passes through the blades of a high speed blower and there is no grinding out of pipes from material carried through them at high velocities.

Briefly, the installation of centrifugal separators in closed circuit with ball or tube mills has the following advantages.

1. Capacity is increased 25 to 100 per cent.
2. The horsepower per ton of ground material is reduced.
3. Positive adjustments at any mesh from 60 to 350.
4. Product is absolutely uniform at all times.
5. A higher percentage of impalpable powder.
6. Product does not contain coarse oversize.
7. Produces moderately fine, fine or superfine material.

When used in closed circuit grinding the centrifugal separator has the following advantages.

1. Low power costs per ton of material.
2. Little wear and tear cost.
3. Little attention.

4. Simpler installation.
5. Can be used with existing mills without rebuilding.
6. Positive separation.
7. Not affected by variations in speed.
8. Will produce finer material.
9. Requires no blowers or dust collectors.
10. Slow speed and automatic lubrication.
11. Operates at the same speed for all mesh products.
12. No coarse oversize in product.

An exploded theory, but one that still persists, is that when mixed materials are ground and separated in closed circuit the softer material is removed first, changing the proportion of the mix. As a matter of fact, when starting up a new unit there may be a slight change in analysis for the first few minutes but this quickly corrects itself and the product is exactly the same analysis as the feed..

Another theory is, that drawing the dust out of the mill by means of an exhaust far increases the capacity. Tests, however, show that by forcing the feed through the mill rapidly, elevating and separating the product, and returning the tailings, the centrifugal separator and elevator installation gives a large capacity and great efficiency.

Bureau of Standards Annual Report

SCIENTIFIC investigations and tests resulting in large savings to the Government and to American industry through improvement in processes and the fixing of uniform standards are featured in the annual report of Doctor George K. Burgess, Director of the Bureau of Standards, submitted to Secretary of Commerce Hoover and released today.

Investigations made during the year with orifice meters for measuring gas, corrosion of underground pipes, and tests conducted covering impact stresses in highway bridges, braking systems for automobiles, and other studies, have resulted in the application of improved methods in engineering practices that are of direct and substantial savings to the industrial public, Mr. Burgess states.

Other contributions to the public interest enumerated in the report are the successful development of methods of reducing the loss in the baking of Japan ware, the assistance rendered the optical-glass industry in the United States, the progress made in the better utilization of cotton linters and other cotton wastes, and the development of a method for reclamation of gasoline from dry-cleaning processes.

An increase of more than one hundred and twenty-five times its initial volume has taken place in the testing work of the Bureau of Standards during the 23 years of its existence, the report states. During the year just closed 135,852 tests were conducted by all divisions of the Bureau, as compared with 115,729 in 1923.

"Most of the tests of the past year were executed for other branches of the Government, practically every branch making use of the facilities provided. A great deal of testing, however, is done for commercial firms and for individuals, over 40,000 test folders, covering over 600,000 such tests, for which a charge is made, having been issued since the founding of the Bureau. The Government work is given precedence, however, and in some cases all testing except that for the Government has had to be refused because the demand exceeds the facilities for doing this work."

The inability to meet this demand is unfortunate, Mr. Burgess points out. It is very desirable for the Bureau to carry out certain tests for outside parties, he claims, not only as a means of assisting American industries and citizens but because the information so gained is of value to the Bureau. "The Bureau has no intention of entering into competition with commercial testing laboratories, but there are certain classes of work which are considered desirable for it to undertake because the results would be of public benefit."

At the present time over 85 per cent of the scientific instruments used in the United States are manufactured in this country. There has been a tremendous extension of the use of instruments in all fields of industry. In the meantime the Bureau's facilities for testing these types of apparatus have not been materially increased and the American manufacturers have been greatly handicapped by their inability to get adequate service from the Bureau in developing and testing their instruments. In some cases American manufacturers have been compelled to adopt unsatisfactory substitutes for adequate tests.

Highway Research Board Holds Fourth Annual Meeting

Highway Materials, Finance, Maintenance and Traffic Discussed in Detail. Paving Materials Production During 1924

HIGHWAY PROBLEMS of every character, including construction, financing, contracts, materials, maintenance and traffic were discussed in detail by delegates to the 4th annual meeting of the Highway Research Board, of the National Research Council, in session here December 4-5. There were eight subjects of discussion on the two-day program, in addition to reports of committees on various phases of highway work.

Losses on Defaulted Highway Contracts

What probably was considered the most important subject under discussion and the one which elicited the greatest interest of the 300 delegates, representing every state in the Union, was that pertaining to losses due to defaulted highway contracts. This subject was brought before the gathering by Frank Page of the North Carolina State Highway Commission. He read a paper entitled "An Analysis of Defaulted Highway Contracts." After reading his paper he opened discussion on the subject of defaults rather unexpectedly. In consequence the board did not name a committee to go into the subject, but it was stated that in all probability a special committee would be named later and a report on the subject submitted at the next meeting.

According to Mr. Page many highway executives have shown anxiety because of the number of highway contractors who have defaulted their contracts. Unless something is done to prevent the increasing number of defaulted contracts, the State, contractor, bonding company and material men are all bound to be losers. Lack of finance, equipment and knowledge of the class of work undertaken are the main reasons for many defaults.

It was brought out by Mr. Page that many of the states have suffered a greater loss through defaulting contractors than have the bonding companies, and it was his opinion, which seemed to have the approbation of those present, that the bonding companies should be persuaded to be more particular in bonding road building contractors. If this were done, Mr. Page thought, there would be fewer defaults and, in consequence, reduced losses by the states.

Thomas H. MacDonald, chief of the Bureau of Public Roads, joined in the discussion and asserted it as his belief that the bonding companies should make a more careful study of their risks before issuing contract bonds. Many contractors take a job and expect they can pay for their equipment, carry their payroll and at the same time make a profit. Frequently the contractor who does not have a cash reserve is forced to abandon the work because of his inability to meet current expenses. Mr. MacDonald suggests that the best remedy is the practice of several States requiring the contractor to have a certain balance, or some other definite financial arrangement, before the contract is awarded.

The subjects under discussion during the session, including committee reports, were:

Other Subjects Considered

"Financial Value of Highway Research," Thomas H. MacDonald, Chief of Bureau, of Public Roads; Report of Committee on "Economic Theory of Highway Improvement," T. R. Agg, Chairman, Iowa State College; "Practical Application of Theories of Highway Design," E. W. James, Chief, Division of Design U. S. Bureau of Public Roads.

Report of Committee on "Structural Design of Roads," A. T. Goldbeck, Chairman, U. S. Bureau of Public Roads; Report of Committee on "Highway Finance," H. R. Trumbower, Chairman, Senior Transportation Economist, U. S. Bureau of Public Roads; "An Analysis of Defaulted Highway Contracts," Frank Page, North Carolina State Highway Commission.

Report of Committee on "Highway Traffic Analysis," G. E. Hamlin,

Chairman, Connecticut State Highway Commission; "Comprehensive Research Program Justified Because of Increase in Efficiency in Highway Improvement and Economic Utilization of Highway Transport," A. H. Blanchard, University of Michigan and President of National Highway Traffic Association; Report of Committee on "Character and Use of Road Materials," H. S. Mattimore, Chairman, Pennsylvania State Highway Department; "Economic Selection of Road Building Materials," W. E. Hawkins, Maintenance Engineer, North Carolina State Highway Department.

Report of Committee on "Maintenance," W. H. Root, Chairman, Iowa State Highway Commission; "The Necessity of Research to Reduce the Cost of Highway Maintenance," W. H. Connell, Pennsylvania State Highway Department; "Practical Use of Traffic and Cost Data in Highway Maintenance," G. C. Dillman, Michigan State Highway Commission; "Special Investigation on the Economic Value Reinforced Concrete Pavement," C. A. Hogentogler, Highway Research Board.

Congress has the constitutional right to authorize the issuance by the Interstate Commerce Commission of preference order for the use of railroad cars in times of emergency, the Supreme Court has just held in an opinion delivered by Justice Holmes in a case brought by Edward P. Avent, Jr., of Michigan, from the Federal District Court at Cincinnati, Ohio. That Congress has such power "no longer admits of dispute," the court declared.

Congress did not exceed its authority, the court declared, when in the Transportation Act of 1920 it authorized the commission, whenever it is of the opinion that shortage of equipment, congestion or traffic or other emergency exists in any section of the country, to suspend its rules as to car service and to make such reasonable rules with regard to it as in the commission's opinion will best promote the service in the public interest, and among other things to give direction for preference or priority in the transportation or movement of traffic.

The Department of Commerce announces that, according to data collected at the biennial census of manufactures, 1923, establishments engaged primarily in the manufacture of paving materials reported products valued at $71,648,660, an increase of 17.2 per cent as compared with 1921, the last preceding census year. This industry classification covers establishments whose principal products are paving blocks (including granite but not including other forms of stone) and paving materials of all classes, mixed and unmixed, for streets, sidewalks, and floors. In addition, paving materials were manufactured to some extent as secondary products by establishments engaged primarily in other industries. The value of such products thus made outside the industry proper in 1921 was $2,797,639, an amount equal to 4.6 per cent of the value of products reported for the industry as classified. The corresponding value for 1923 has not yet been ascertained but will be shown in the final report of the present census.

The department also announces that for the same period establishments engaged primarily in the manufacture of wall plaster, wall board, and floor composition reported products valued at $73,800,539, an increase of 46.9 per cent as compared with $50,226,758 in 1921, the last preceding census year. The value of the wall plaster produced was $37,825,147; of wall board, $20,627,408; of the floor composition, $3,455,906; and of all other products, such as putty, mortar, plaster lath, blocks, tile, etc. (and also probably including some wall plaster, wall board, and floor composition not specifically reported as such), $11,892, 078.

Celite: Insulation of Kilns

A new book, *Bulletin B-20 B*, just issued by Celite Products Company of New York on "Insulation in the Rock Products Industries," describes the new Sil-O-Cel Rotary Kiln Brick in rotary lime and cement kilns. The bulletin describes Celite Kiln Insulation as applied in all the rock products industries which employ burning or calcining operations,—cement, lime and gypsum.

The book also covers the burning of lime in shaft kilns as well as the use of insulation in the making of Sand-Lime Brick and in the calcination of gypsum.

Doings in Indianapolis

Results Industrial Show Reported. State Highway Commission Outlines Road Paving Program. Other Doings

By Our Indianapolis Correspondent

THE sand and gravel trade in Indianapolis is enthusiastic over the results obtained and the interest aroused in the Industrial Show which was held at the state fair grounds from October 11 to 18. A similar show was held in 1921, but the display this year so far surpassed the other show that there was no comparison. During the seven days of the display more than 200,000 persons inspected the exhibits, which is believed to have set a record for attendance at such exhibitions. The show was held in a new building erected this year by the state, said to be the largest building for display purposes in the Middle West. It is more than 800 feet long and when arranged for display purposes, has about two miles of aisle space. One day during the show more than 65,000 persons attended, by far the largest crowd attending any function ever held in Indiana.

By special arrangement with school officials, each morning was set aside for school children of the city, a certain number of schools permitting their students to attend on that particular day.

Officials of the Indianapolis Chamber of Commerce, who sponsored the show, say it was held largely for educational purposes, the desire being to acquaint the public with just what is made in Indianapolis. With the attendance record, it is estimated that more than half the citizens of the city went to the show sometime during the week. Dozens of requests for space were turned down because the products did not happen to be made in the Hoosier capital.

Among the trade's exhibitors were: Atlas Sand & Gravel Co.; Granite Sand & Gravel Co., Helm-Lewis Cement Block Co., Indiana Gravel Co., Indianapolis Concrete Products Co., O. L. Miller Company and Shearer and Mayer.

The Indiana state highway commission has outlined a program for paved road construction for 1925 that embraces the definite decision to build a total of 226.6 miles of hard-surfaced roads in the highway system of the state, according to John D. Williams, director of the commission. In addition, the commission has agreed on a tentative schedule for the paving of 77.2 miles more, if the revenue next year is sufficient. The announcement gladdens the hearts of road contractors, sand and gravel and cement producers, for, if the contracts are awarded as they usually are, most of the roads will be of concrete.

If the commission can carry out its tentative program as well as its definite program it will mean that the 1925 program will call for the construction of 303.8 miles of paved roads. The definite schedule is about the same extent of mileage as programs of previous years. The highway commission will govern its program largely by revenue, a large part of which is provided by the tax on gasoline. It is probable a bill will be introduced in the state legislature that convenes in January for the repeal of the law which places a two-cent tax on gasoline for road building purposes, but the general belief is that such a bill would be defeated.

The announcement of the road program followed Williams' announcement that almost 1,000 miles of hard surface roads had been added to the state highway system. This includes new trunk lines and connecting links. These roads have been approved by Governor Branch, and the list has been submitted to the federal government. The addition of these lines brings the total mileage in the state to 5,039.5 miles.

In addition to the program, it was learned that the commission, while withholding any formal expression in the matter, favors and feels that the public approves increasing the state tax on gasoline used by vehicles that operate on the highways. The commission has taken no action on this matter and has given no expression as to how much the tax should be increased, though it is generally known that the members favor an increase. If some action is taken in the legislature to place state control over busses and trucks operated on the highways, it is likely this increased revenue will be turned over to the state highway commission.

What promises to become an open breach between the crushed limestone and sand and gravel interests of Indiana was aired recently before the board of county commissioners in Indianapolis when a protest against changing the plans and specifications for a road improvement from gravel

to stone was made by a committee representing the Marion County Sand-Gravel Association. The committee presented figures which they said showed the county this year had spent for stone construction of roads $375,000 in excess of what the same work would have cost had gravel been used instead of stone. They contended that stone was not better for roads than gravel. The gravel may be had in Marion county, they said, but stone must be shipped in. The county engineer of Marion county has informed the board that gravel, he believes, is of equal value in road making and advised its use because of its lower cost. The sand and gravel producers in Marion county are taking action to fight county commissioners on the stone idea.

D. C. Stephenson, former grand dragon of the Ku Klux Klan in Indiana, has announced the sale of the Central Sand and Gravel Company to L. G. Julian of Evansville, Ind., for a total sum, he said, of $200,000. He has accepted a position as general manager of a New York firm at a salary of $25,000. He asserted also that he had caused to be written into the contract for the sale to Julian a provision that the company could not sell its product to the state during the term of the next Governor.

George Nattkepper, of Terre Haute, Ind., well known to sand and gravel producers of Indiana, has been named one of the Presidential electors on the republican ticket. Mr. Nattkemper always has taken an active part in politics.

The unoccupied plant of the Sandusky Portland Cement Company at Syracuse, Ind., near Lake Wawasee, was destroyed by fire recently.

The Indiana board of tax commissioners has increased by $90,650 the assessment against the personal property of the Louisville Portland Cement Company, which operates a plant at Speed, Indiana.

A new catalog has been issued by The Thew Shovel Co. of Lorain, Ohio, on the Type O Gasoline Shovel, also a folder. The catalog describes construction of the shovel in detail, the folder being the story of a canal dug at Niagara Falls, New York, with Thew Shovels.

The General Electric Company of New York recently closed a contract for complete electrical equipment for a new cement mill at Coreen, Pa., operated by the Clinchfield Portland Cement Corporation of Kingsport, Tenn. Two 1,000-Kilowat turbo-generators, a 16-panel switchboard, over 60 induction motors of various sizes and 6 synchronous motors, 4 rated 500 H. P. and two 300 H. P. were installed.

Ohio Considering Budget

The Ohio State Highway Department has just submitted a budget calling for $43,572,390. This is a great increase over the last budget which was $18,000,000 for the two year period expiring June 30, 1925. The Highway Department is requesting the new budget for a two year period to practically complete the highway system of the state.

At the present time there are 6,300 miles of roads under state maintenance completed. Financed and under contract are 700 additional miles. This leaves 3,500 miles to complete. The budget is for the construction of 2,000 miles of highway in the period from June 30, 1925 to June 30, 1927. This will complete all but 1,500 miles of the state highways. About 20 per cent of this budget is for gravel and stone. An additional sum of $23,000,000 will be used for maintenance and repairs.

George F. Schlessinger, Assistant Director of Highways makes the statement that it is more expensive not to carry through this program than to adopt it. The movement for the adoption of this budget is supported by the Ohio Good Roads Federation, many civic organizations, automobile and other associations.

Tieco Industrial Cars

In its new publication, *No. 3, Car Catalog*, The Industrial Equipment Company of Minister, Ohio, shows a largely increased line of products.

This company manufactures a complete line of Industrial Railroad Equipment from 15-ton Gasoline Locomotives and 15-ton Flat Cars to a 2-ton Locomotive and 18 in. gauge 1-ton or one cubic yard cars with trackage, switches, frogs, transfer cars, turntables, etc.

The catalog is illustrated with many illustrations of car types, diagrams, and equipment in use on the job.

What plant operator would permit the illicit tapping of his power wires and the diversion from his own use of a large portion of his power? Friction, belt slippage and unnecessary transmission losses successfully accomplish the same thing daily in many plants. What plant operator would pay toll to a competitor on his own trucks as they pass out of his plant loaded? Poor driveways are accomplishing the same effect daily in many plants.

New Type Car Dumper

THE cut shows an unique form of car dumper which has recently been developed to dump a special form of car which is particularly adapted to the heavy service in quarrying and mining operations when steam shovels are used to load the cars.

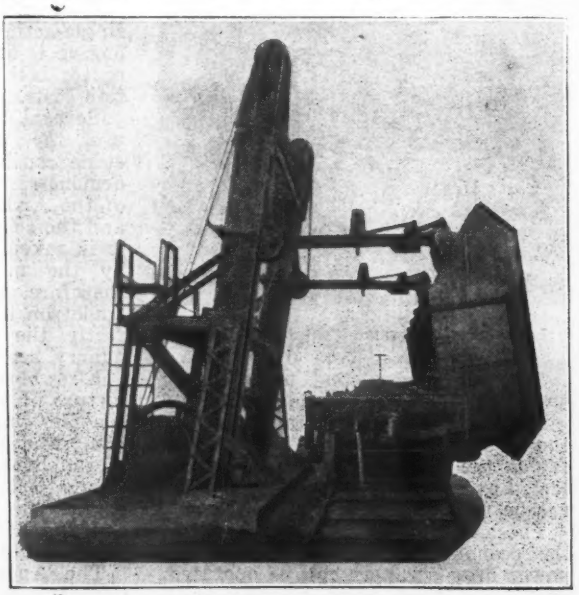
In quarrying operations for large cement plants many different types of cars have been tried and found incapable of standing up satisfactorily under the extremely severe service which is encountered where large steam shovels are used to load the cars. This is the case in practically every large operation where it is necessary to get large capacity at minimum cost. Some years ago The Atlas Car & Manufacturing Company of Cleveland, Ohio, developed a special type of car for these quarrying operations, which has given very satisfactory service and which is rapidly becoming standard for quarry use under the conditions mentioned. This car consists essentially of a truck or frame which is mounted in the usual way on extra heavy wheels and axles with heavy journal bearings and spring pedestals to protect the equipment. The body or hopper of the car is made of an entirely separate but one hoisting rig is unit of extremely heavy construction. It rests directly on the framework when carrying the load, but when the car reaches the dumping point the hopper is tilted so that the contents can easily slide out, generally into the chute of the crusher.

This construction has important advantages. In the first place there are no moving parts or mechanism to get out of order. The hopper is simply dropped in place and automatically held by suitable blocking. When it is tilted a hoist of some type is used, but there is no machinery on the car. It will be obvious that this is a wise arrangement in view of the fact that ordinarily provided for a large quantity of cars, and aside from the annoyance and cost of maintaining dumping mechanism on all the cars, it is far simpler and certainly far cheaper to have but one dumping station which can and does receive the proper attention at far less cost than all of the cars could be maintained.

An additional advantage is that in case any of the hoppers or bodies are damaged by the fall of large rocks, it is a very simple matter to throw the damaged body aside until it can be repaired and replace it with a spare hopper. The entire design of the car lends itself particularly well to rigid construction.

In order to handle this large capacity car a special form of dumper was necessary and The Atlas Car & Mfg. Co., finally designed and built the dumper shown.

The particular feature of this dumper is that the operator has absolute control of the dumping hopper at all times, as the hopper is rigidly connected to the dumping device in such a manner that the hoist can be stopped at any point or, if necessary, the hopper can be shaken in order to loosen any material which



The Atlas Car Dumper.

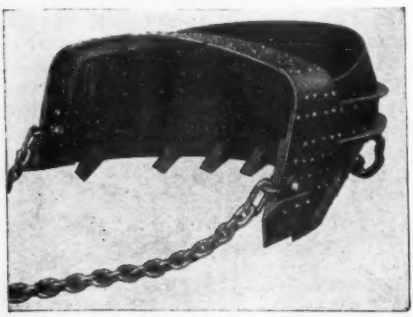
should happen to stick in the hopper.

The operation of the hoist is as follows: The loaded car is brought into position in front of the hoist and the operator starts operation by hoisting the two trolleys to which the dumping arms are connected. These dumping arms automatically lock to suitable trunnions on the car hopper and as the trolleys are hoisted the body is forced up and over to the dumping position, but always under absolute control of the operator. Replacing the body simply means reversal of these operations.

Sauerman Improvements

IMPROVEMENTS in Sauerman Bros. equipment during 1924 include the adoption of renewable wearing blades and manganese steel teeth as standard equipment for "Crescent" (Patented) Power Drag scraper buckets.

All sizes of "Crescent" buckets are now equipped with wearing blades, bolted to the lower body plates of the bucket. These blades can be adjusted or replaced as they are worn down, and the life of the bucket body is extended over a long period of time. The replacement of the wearing blade also renews the capacity of the bucket whenever necessary.



Large Size Sauerman "Crescent" Bucket

The manganese steel teeth are of special design, and not only make digging easier but assist in protecting the body plates. The bolts which fasten the teeth to the body are protected by tooth plates so that they will not be worn off by abrasive wear.

These new standard features add to the economy with which "Crescent" power drag scrapers can be operated, and have been very popular with users of these machines.

The Anderson Engine

THE Anderson Engine & Foundry Company of Anderson, Indiana, has taken over the affairs of the old Anderson Foundry and Machine Company, and has decided to use the large shops and foundry only for the production of the Anderson Oil Engine. The new company has energized the experimental and research departments, so essential to the production of a successful engine, and already is finding results in the large volume of business written for delivery within the next 60 or 90 days.

The Anderson Engine is built in three different cylinder sizes, and in 1, 2, 3, 4, and 6 cylinder units, and is of the vertical, single acting, 2-cycle type, which has demonstrated itself to be a cheap, sturdy and reliable prime mover for isolated power plants.

The immediate effort of the Anderson Engine & Foundry Company is directed to the further refinement of the engine along already established lines, and comprises largely the application of improved tools, fixtures, jigs, etc., to facilitate multiple production. It also includes the raising of the standards of inspection to such an extent that the name, ANDERSON, will be synonymous with the very best that fine equipment and experienced organization can produce.

Necessarily the simplicity of the single-acting, 2-cycle, multi-cylinder engine is attractive to the quarry operator both for low initial and operation costs.

Several Anderson Oil Engines in use for operating gravel pumps, stone crushers, drag lines, etc., have demonstrated conclusively the utility of the Anderson product in this field, and the success met is so general that it is taken as a very favorable sign by the new Company. They are, therefore, endeavoring to modify the Anderson equipment so as to fit perfectly the requirements of pit and quarry service.

Elsewhere in this issue is shown a picture of a 180 H.P. Type K Anderson Oil Engine supplying power for pump and other purposes in the plant of the Lenawee Sand & Gravel Company, Tecumseh, Michigan. This engine was installed some two years ago and has given complete staisfaction to date.

The Anderson Engine & Foundry Company is proving itself to be well equiped to meet competition.

The "Apex" CO_2 Indicator

A NEW boiler room instrument, known as the "Apex" pneumatic CO_2 indicator has been developed primarily to meet the demand from the smaller steam power and heating plants for a simple and inexpensive instrument for measuring the fuel wasted up the chimney.

The manufacturer claims that the "Apex" CO_2 indicator will operate accurately with about five minutes attention once a week. The price is very nominal. It is stated that this investment is generally warranted for steam boilers even as small as 50 horsepower, in view of the fuel savings that can be expected through the intelligent use of a reliable CO_2 indicator.

The "Apex" CO_2 indicator consists of two principal parts, namely the actuating device, known as the CO_2 meter, and the gauge proper, known as the "Type Z" indicator. The flue gas flows through the CO_2 meter continuously, developing a changing pneumatic pressure within it, the magnitude of the pneumatic changes depending upon the percentage of CO_2 present in the gas. The CO_2 is absorbed in a dry cartridge placed in the CO_2 meter. The absorption of CO_2 causes a shrinkage of the gas flowing through the CO_2 meter and hence a reduction in the pneumatic pressure. Any given percentage of CO_2 in the gas will produce a definite pre-determined pneumatic pressure, which is employed for operating the Type Z indicator. The indicator consists simply of a manometer containing a glass tube filled with colored liquid, which changes its level according to the pneumatic pressure applied to it. A scale located beside the indicating manometer is graduated in percentages of CO_2.

A simple steam or water aspirator is used to draw the gas from the boiler, through the meter. A large volume of gas is bypassed around the meter at the same time, under the action of the aspirator, which results in speedy response to change in furnace conditions.

The suction from the aspirator is maintained constant by a simple hydrostatic regulator regardless of possible aspirator pulsations. This regulator is simply a closed vessel filled with water, the space above which is connected with the aspirator. An air inlet pipe extends into the water to a point near the bottom of the vessel and is so arranged that air may be drawn in through the bottom of this pipe and caused to bubble up through the water under the effect of the suction above the water. This bubbling air automatically prevents the suction from increasing beyond the point for which the regulator is designed. The water level in this regulator is kept constant by a fixed overflow. A similar hydrostatic regulator, placed in the inlet bypass, previously mentioned, likewise acts to hold the suction on the inlet side of the machine constant, irrespective of any variations in the chimney draft.

In entering the CO_2 meter, under an unvarying inlet suction, the gas first passes through a constricted passage, then through the dry absorbent cartridge and then emerges through a second constricted passage, escaping under the constant exhaust suction, previously mentioned. Each of the two constrictions consists of a tube of definite length and bore, which acts as a fixed resistance to the flow of gas. There is no resistance in the absorbent cartridge, the gas flowing freely through it at all times. These cartridges are each guaranteed for a life of 1,200 per cent hours and are easily renewable when used up. The pneumatic pressure existing between the two constrictions is at all times below atmospheric pressure, and as the percentage of CO_2 increases, the pneumatic pressure decreases correspondingly over a wide range because of gas shrinkage due to absorption. The Z indicator is connected to the absorption chamber by means of small bore tubing, and it instantly responds to all fluctuations in the pneumatic pressure.

A point of particular interest is that at no time is the gas hermetically sealed in the CO_2 meter. This fact makes it always possible for the indicator to point to the percentage of CO_2 existing in the meter at the moment.

Because of the simple pneumatic principle employed, the design is entirely devoid of mechanically operated parts, special glassware and rubber tubing. In the actual construction of the CO_2 meter, there is a chamber on the left containing the dray absorbent cartridge and a constricted passage

for the overflowing gas. The vessel has on the right an inlet gas regulator. The gas from the boiler enters through the vertical pipe at the top of the instrument and flows into the small chamber adjoining it which contains the inlet constricted passage. A horizontal pipe entendnng to the left is the outlet which conducts the gas to the outlet regulator and aspirator. This equipment is fully illustrated in the catalogs.

The "Apex" CO_2 indicator employs the "Pyro-porous" filter, which is placed on the end of the sampling line within the boiler setting and completely excludes soot and ash. Another important claim for the "Apex" instrument is the elimination of sulphuric acid fog from the gas and the complete drying of the gas which prevents corrosion of the sampling line.

The Curtis Compressors

The Curtis Model "A" compressors were recently redesigned all the way through with the idea of increasing their speed, hence their capacity; in other words, giving the customer, without and increase in price, considerably more compressor capacity.

The Curtis Pneumatic Machinery Company has not in any way sacrificed the performance or safe and proper design and construction in increasing the capacity of these compressors, as the changes were made in the valves, bearings, pistons and connecting rods commensurate to the new speed requirements. These new machines have been operating at these speeds under test for over a year, under actual working conditions, so that there has been ample opportunity to prove that they are right.

The Curtis Fordson air compressor unit also ought to appeal to many quarrymen, as it gives a portable compressor, self-propelling, using a standard Fordson tractor, the whole outfit is available at a small cost. With the Curtis outfit, when there is no call for air, the trailer is quickly and easily detached without special tools, leaving a standard Fordson tractor available for all ordinary power and haulage purposes.

Bulletins giving full details on both classes of equipment are available by addressing Curtis Pneumatic Machinery Company, St. Louis, Mo.

Smith Achievements

Two years ago the Smith Engineering Works of Milwaukee Wisconsin began the manufacture of Telsmith crushers with steel frame and steel crown. This frame, crown and shaft are guaranteed against breakage by tramp iron. The last two years have been test years to determine whether producers wanted and were willing to pay for a steel structure and also to ascertain to what extent steel was preferable to iron. The conclusions now claim that a large percentage of the producers are prepared to pay a substantial premium for a steel crusher structure and they also claim that a steel crusher will stand up under service that would break an iron machine. The Smith Engineering has had only one claim presented under their guarantee and that was not due to breakage but a flaw in the casting.

The Smith Company have taken over the manufacture of a grizzly that was invented by H. Littlewood an employee of the Moctezuma Copper Company. This grizzly is the Telsmith Rotary Grizzly and is manufactured in 24, 30 and 36 inch diameters.

The other new equipment consists of the Telsmith Plate Feeder and the Telsmith Apron Feeder. The plate feeder is a self-contained feeder unit for regulating the flow of material for gravel plants. It has a capacity ranging from 10 to 100 cubic yards per hour.

Jones Issues New Catalogs

Catalog No. 31 on Jones Power Transmission Machinery covers shaft hangers, pillow blocks, couplings, collars, belt tighteners, mule stands, bench legs, etc.; all items are well illustrated, listed, diminished, tabulated, etc. The catalog covers the very latest data on a completely rounded out line of quality transmission appliances.

Catalog No. 32 on Jones Sprocket Wheels and Chain Belting covers a full line of sprocket wheels and chain belting, as well as chain tighteners, elevator boots, buckets, bolts, hand wheels, etc., illustrations listing prices and complete specifications on all items shown.

These catalogs may be had upon request from W. A. Jones Foundry and Machinery Company, Chicago, Ill.

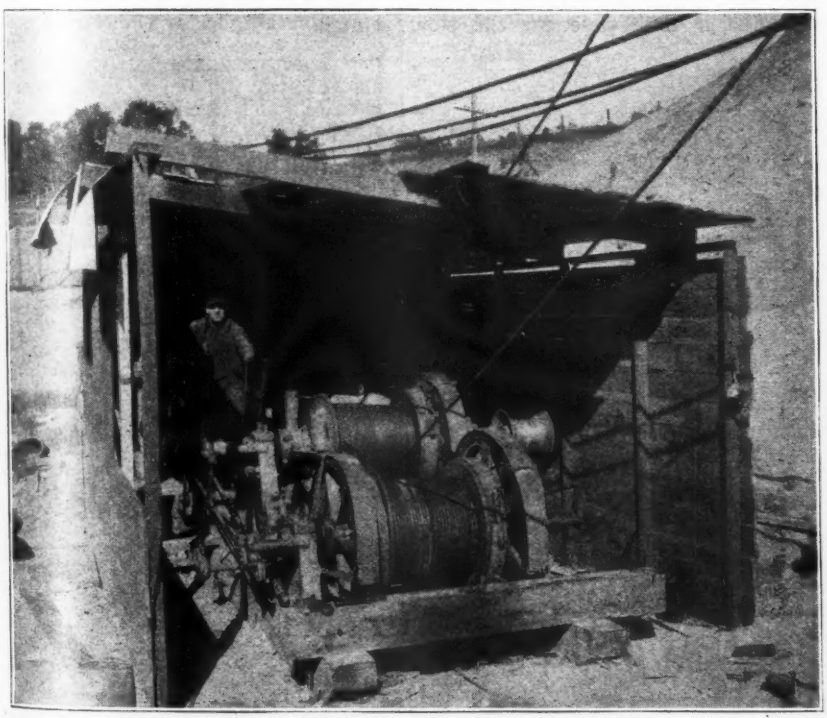
New Electric Excavator Hoist

DUE to the constantly growing demand for the use of slack line excavators for the handling of gravel and the lack of hoists primarily intended for this service, Mead-Morrison Mfg. Company has brought out a new hoist specifically designed for use with slack line excavators.

It has been the aim in the new design not only to overcome the difficulties in existing machines used for this purpose but also to simplify the operation of the hoist so that the time of manipulating the levers will be cut to a minimum allowing the operator to handle the greatest possible yardage of material per day. In the old machines a slip ring motor having drum controller was an essential, but in the new design with the Mead-Morrison patent automatic brake, a constantly running motor is used, thus relieving the operator of the extra effort and time involved in starting and stopping the motor with each trip, also avoiding the peaks due to such operation. These machines have the usual arrangement of two tandem friction drums, one arranged for two speeds for the drag line, and the other for single speed for tightening the inclined cable, both these drums being provided with brakes constructed to automatically sustain the load at all times and adapted for lowering the load.

The brakes on the drums normally are set against reversal of drum and lowering of load, but automatically take the load when the friction by which it is hoisted is released. The operator thus does not have to set a brake to hold the load when he releases the friction by which it has been lifted. This practically cuts in two the manual labor of handling the load.

The drum clutches are all of the friction cone type, arranged to secure uniform expansion due to heat. The inner cone of each clutch is covered with asbestos brake lining so applied that the lining can be removed and



The Mead-Morrison Hoist.

replaced without removing the drum shaft from its bearings.

The upper or cable drum is provided with clutch at one end of the drum, driven by corresponding drum gear. The lower, or drag line drum, is provided with clutch at both ends, each driven by corresponding drum gear. The clutch at one end of the drum is of large diameter for heavy pull and engages with gear driven at slow speed, this gear being bronze bushed and turning on the shaft to which the drum is firmly keyed. The opposite end of this drum is provided with clutch of smaller diameter driven by corresponding gear to give high speed for pulling the bucket up the inclined cable. The gear is also bronze bushed and turns on the shaft.

The clutch for the high speed gear is of standard construction, but the larger clutch for the slow speed gear at the opposite end of the drum is of the automatic releasing type. This clutch, when applied, is effective to turn the drum in the rope winding direction, but is ineffective to resist rotation of the drum in the rope winding direction relative to the slow speed gear, this construction being provided to make it impossible for the slow speed friction to pull against the high speed when the load is being transferred from the former to the latter after the bucket has been filled, and to simplify the operation of the excavator. In operation when, with the slow speed clutch thrown in, the bucket is nearly filled, the operator throws in the cable line clutch with one hand to lift the bucket. When the bucket is hoisted clear of the ground so that the heavy line pull is not required, the high speed clutch is thrown in by his other hand and the drum is then driven by the high speed clutch, the slow speed clutch having automatically released the drum to run at the higher speed. This absolutely prevents any overloading of the motor or excessive heating of the frictions due to simultaneous application of both low and high speed clutches which is liable to happen with the usual arrangement of clutches unless the operator is very careful. Furthermore, as the operator has not needed to throw out the slow speed clutch, this clutch will automatically become operative for slow speed pull when the dumping position is reached, upon the release of the high speed clutch.

The Highland Sand and Gravel Company's Plant.

For operating this machine, Mead-Morrison have provided five banked levers with latches and quadrants as follows: No. 1 lever for applying the slow speed drag line clutch; No. 2 lever for applying the high speed drag line clutch; No. 3 lever for releasing the automatic brake on the drag line drum; No. 4 lever for applying the clutch of the cable drum, and No. 5 lever for releasing the brake on same. It is unnecessary with these machines to start and stop the hoist each trip as equally smooth and more rapid and efficient operation is obtained by running the motor continuously.

Expansion of Iowa Crusher Equipment Manufacturers

AMONG the manufacturers of machinery serving the quarry field is the Universal Crusher Company of Cedar Rapids, Iowa. This concern serves the entire rock crushing field, manufacturing 24 sizes of stone and gravel crushers. These are in use everywhere by general contractors, highway builders, cities, townships, counties, concrete products plants, brick and tile plants, quarries, and gravel pits.

Its old quarters having been outgrown, the Universal Crusher Company has erected a new shop and office building with more than 22,000 square feet of shop floor space. This has been equipped with the most modern machinery and labor-saving appliances to assure customers of prompt and efficient service at all times. A modern pattern room, fully equipped for building, altering and maintaining patterns is another very important feature.

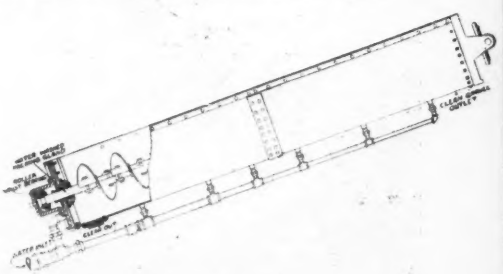
The Universal Crusher Company was organized in 1909. Five years later the Eureka Stone and Ore Crusher Company was absorbed, and since then there has been a steady and consistent growth. The company claims the world for its market, having shipped machinery to every state in the Union, also to Canada, Mexico, Central America, the West Indies, South America, Africa, Australia, Europe and the Islands of the Pacific.

Equipment is furnished in either stationary or portable styles. A line of pulverizers is also manufactured, for the reduction of limestone, slag, cinders, glass, etc., much in demand by farmers and producers of commercial agricultural limestone.

The Eagle Gravel Washer

THE gravel washer and sticker manufactured by the Eagle Iron Works, Des Moines, Iowa, has a 24 inch tub with water inlets to the bottom, set on an angle so that the water flows toward the lower end. The gravel is fed into the lower end and conveyed through the water by means of a chilled iron screw with replaceable flights, so that any section may be replaced without taking out the screw. The action is such that the gravel is constantly agitated thus causing all sticks, silt, coal and shale to flow out over the outlet with the dirty water while the gravel is conveyed up the inclined tub and out the upper end.

A rather unique feature of the apparatus is the manner in which the thrust bearing is protected. The thrust bearing is a Timken or Gillian combined radical and thrust bearing set back and entirely outside the tub. Between the bearing and in the end of the tub is a packing gland. A flow of water is forced into the tub along the shaft thus preventing sand or grit from encountering the packing in the gland and cutting the packing out.



The Eagle Washer.

This washer is suitable for removing refuse, of any sort that is lighter than the gravel itself, mud balls and silt are entirely removed. The equipment may be added to the equipment of any sand and gravel plant at a very slight expense.

The Capitol City Sand Company of Des Moines, Iowa, by the use of one of these gravel washers avoided a shut down and also the moving of their pit during the rainy season with one of these washers. The river washed sufficient refuse into the pit in the river bed so that if it had not been for this washer, the gravel would have been useless.

Developments on Excavating Machinery By the P & H Company

DURING the past year, the P & H Company has been adding many improvements and developments to the field of excavating machinery. Combining the experience of a number of years in the design and production of such equipment with the ever increasing demand for strong, durable, gasoline-powered excavators, the resulting rapid progress has been a credit to the company and a gratification to the owners and users of the machines.

What is probably the most noticeable improvement to the casual observer is the new all-steel cab, with which all P & H Excavators are now being equipped as standard equipment. This cab is light in weight, being even lighter than the old-fashioned wooden canopy which was once used. It is very neat in appearance, having the "streamline" effect, with the curved top and back. It is fitted with windows on each side, as well as swing-

The P & H Model 208

ing doors, permitting easy operation and care of the machine and at the same time insuring full protection.

One other feature, which has been adapted to the P & H machines this year is the steering brakes on the Corduroy traction. An individual brake is attached to the driving mechanism of each Corduroy, and thus the operator has complete control of the travel and steering from his seat on the platform. The steering wheel controls a cam mechanism on the lower frame, which automatically releases the jaw clutch on the Corduroy and applies the brake on the same one, while the other continues to travel. This makes the steering positive and fool-proof.

Another valuable feature is the use of the "Ricardo" head on the Waukesha motor, which supplies the motor power. This new head is of a particular shape, giving additional turbulence to the gas vapors in the motor and thereby making a 15 per cent saving in fuel used in the motor and at the same time developing 5 more horsepower, on a 50 H.P. motor.

In accordance with this increased power rating and with a large number of experiments on the rated capacity of the P & H Model 206, the dipper capacity of this machine was increased to ¾ yd. struck measure and the boom lifting capacities were materially increased, but are still based on 75 per cent of the overturning capacity.

This company has also brought out a new type machine, known as the P & H Model 200, embodying very similar features as the Model 206, but of somewhat smaller capacity (¾ yd. heap measure dipper), being of lighter weight and somewhat simplified construction.

At this time the company is celebrating its fortieth anniversary in the production of heavy machinery. It has been a far reach from a small shop, operated by two men to the modern plant, employing about 1,500 persons and controlling the entire process in the production of its machines "From Pig Iron to Finished Machine." In honor of the part which the organization's president has taken in its development, the name is being changed at the present time to Harnischfeger Corporation. There is no change of management, administration or policy accompanying this change of name.

The Pawling and Harnischfeger Company of Milwaukee, Wisconsin, has added a Diesel Driven machine to its line of power driven excavators. The Model 208 machine, which is shown here, is provided with a 1 cu. yd. struck measure dipper and can also be equipped with 1 cu. yd. dragline or clamshell bucket operating on a 40 ft. boom. The Diesel operated machine is a comparatively new development in excavating machinery.

Latest Vulcan Gasoline Locomotive

THE Vulcan Iron Works, Wilkes-Barre, Pa., manufacturers of steam, gasoline, and electric locomotives have recently designed a high-powered gasoline locomotive of the 7-ton size, Class I. G. S., known as the "7-ton Special."

This locomotive is of the worm gear drive type, which drive has been an exclusive feature of Vulcan gasoline locomotives for many years. The worm drive and reversing mechanism is mounted as a unit in a cast steel, oil tight, dust proof housing made in halves, placed in the center of rear axle, permitting of quick and easy assembling or dissembling without the necessity of removing the axle from under the locomotive.

The transmission is of the four speed, selective gear type, gears being of the Constant Mesh Jaw type, wherein the gears are always in mesh, and speed changes are made through the engagement of jaw clutches, and not through the clashing of gears, thereby eliminating all chance of gears stripping, and making possible easier and quicker speed changes without loss of acceleration or momentum to the locomotive and load. The transmission case is entirely enclosed, and protected from dirt and grit by proper packings and covers.

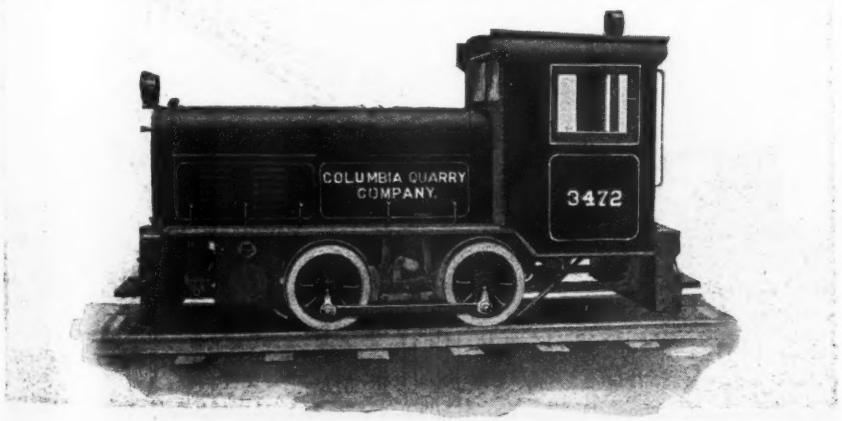
This locomotive has sufficient power to slip its wheels in 1st and 2nd speeds and the drawbar pull at these speeds depends on conditions of track and rolling stock. The rated drawbar pull under normal conditions will be as follows in each speed:—2 m.p.h., 4,200 lbs.; 4⅛ m.p.h., 3,500 lbs.; 7¼ m.p.h., 2,500 lbs.; 10⅛ m.p.h, 1,725 lbs.

Like all other Vulcan gasoline locomotives, this machine follows as closely as possible the general lines of the well known Vulcan steam locomotives. The frames are of open hearth cast steel, locomotive bar type; the bumpers of heavy section cast iron, with separate coupler pocket castings; axles of high grade forged steel; wheel bearings of cast iron, bronze lined, with removable collars; springs of heavy coil type. Wheels are connected by forged steel side rods as in steam locomotive practice.

The cab is of steel, fully enclosed, with sliding doors at rear and clear vision windows all around. The operator sits in the cab facing forward and all levers, pedals, switches and buttons are conveniently arranged for easy manipulation.

The specification of this "7-ton Special" shows the following equipment; Waukesha Model D.U. (Bus) Motor, developing 60 H.P. at 1400 R.P.M. with Splitdorf magneto and Westinghouse self-starter and electric lights (both ends); Stromberg Carburetor; Willard Storage Battery. Radiator is of the tubular type, well protected.

A considerable number of this new model are now in actual service, and all the users have expressed extreme satisfaction with the results obtained, especially in the matter of fuel economy and all-around efficiency. One of these models will be on exhibition at the Good Roads Show, Chicago from Jan. 5th to 9th.



The Vulcan Gasoline Locomotive

A New Light-Weight Industrial Crane

A NEW model light weight industrial crane with interchangeable attachments so that it is equally effective as a crane, as a ditcher, as a shovel, etc., has been recently developed by The Byers Machine Company, Ravenna, Ohio. This model, the "Bear Cat," is virtually six machines in one, built to give speed and economy in all-around work. It is particularly speedy in handling a half-yard clamshell bucket. A good operator, it is claimed, can easily make three round trips per minute with the bucket on ordinary loose material such as sand or gravel. The ditcher attachment has shown itself to be especially popular, a large number having gone into sewer and trench work last summer. The ditcher scoop is furnished in three sizes, 25" to 37", and cuts to a depth of 17 feet behind the machine or 9 feet beside the machine. It will dump at an elevation of 8 feet into trucks, and the power applied at the dipper teeth is 9,500 pounds. The machine can be satisfactorily operated on a grade of 20 degrees.

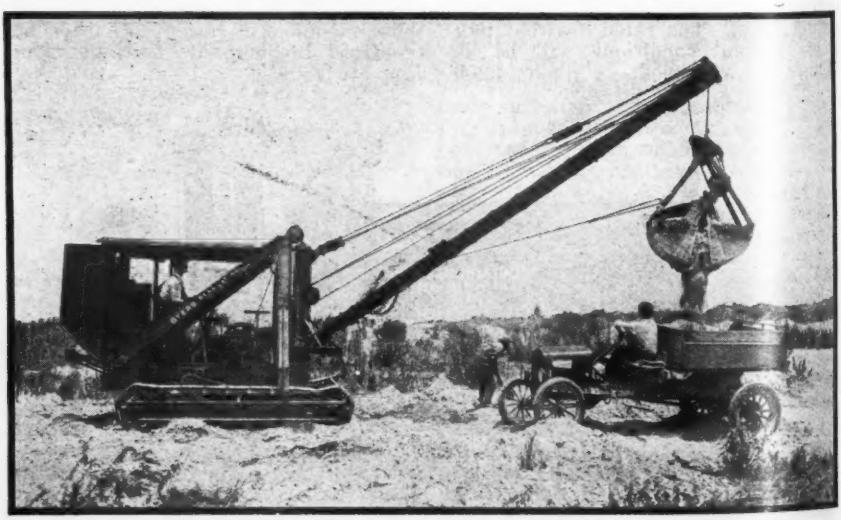
Equipped with skimmer attachment, the "Bear Cat" is said to be a very efficient road grader. It has a 12 foot cutting stroke and a two part digging line, giving it a very great digging power for a machine of its size. The ½ yard bucket is of the bottom dump type, no ground man being necessary. In fact, with all attachments, Byers "Bear Cat" is a one man operated machine. Other attachments provided are a shovel for regular excavating, a back filler, dragline and magnet.

The "Bear Cat" is mounted on full crawlers, spaced unusually far apart, giving it traction and stability on all kinds of ground. It is equipped with a 35-h.p. gasoline engine, and is of exceptionally sturdy construction throughout. It can mount a trailer on its own power for quick hauling by a motor truck. Electric power can be furnished instead of gas where desired.

Osgood Issues History

In a little booklet just issued the Osgood Company of Marion, Ohio, gives a brief history of its growth. It tells of the earliest conception of this line of excavating machinery back in 1840 by Jason C. Osgood of Troy, N. Y., and his first letters patent in 1846. These latter were for improvements on the common crane type of dredge then in use.

The boom type dredge developed in 1872. In 1882 and 1883 large sized steam shovels to run on railroad trucks were built; and about 1890 the company began the manufacture of a revolving steam shovel. The book is an interesting bird's eye view of excavating history.



The New Byers Crane.

Du Pont Improvements in Explosives and Blasting Accessories

DURING the year 1924 three new explosives have been developed by the du Pont Company for quarry use. These are Quarry Gelatin, Quarry Straight and Arctic Special.

Quarry Gelatin has the same merits as other brands of du Pont gelatin dynamite in respect to density, plasticity and water resistance and it is likewise low freezing. In addition, it has the advantage of being stronger grade for grade than the older gelatins, this characteristic being especially noticeable in the lower grades. Quarry Gelatin has been widely used and in many quarries the 30 per cent or 40 per cent strength has been found to yield as good results as were formerly secured with 40 per cent or 50 per cent gelatin. Generally Quarry Gelatin pulls the bottom clean and gives as much breakage as the higher percentage explosive. The use of Quarry Gelatin, therefore, considerably reduces explosives cost per ton of stone blasted. As the name indicates, Quarry Gelatin is designed only for open work. It must not be used underground as its fumes make it unfitted for that purpose.

Quarry Straight is an explosive formulated on the same principle as Quarry Gelatin for outside work only. It is similar to du Pont Straight in all respects except that its fumes are more objectionable and that it is stronger grade for grade. Where Quarry Straight can be used, it will give better execution than regular straight dynamite of the same nitroglycerin in content.

Arctic Special is an explosive of the nitrostarch type. It contains no nitroglycerin, and therefore it does not freeze and does not produce a headache from handling. In quarries where these qualities are considered important, it will be found to fill the requirements admirably. Arctic Special is a little slower than Red Cross Extra and somewhat less sensitive. On a weight basis it has a strength of 52 per cent. It is a non-inflammable powder with fairly good water resistance; even though damp it can be detonated with a dry primer. As it is a comparatively bulky explosive, averaging 124 cartridges, 1¼x8 inches, to the 50 pound case, it gives best results where the bottom is easy to pull and a concentrated charge is not needed.

The No. 3-A du Pont Blasting Machine has been introduced during the past year and the manufacture of the No. 4 and No. 5 Blasting Machines has been discontinued. This is a blasting machine of modern construction and light weight. With a capacity of 50 electric blasting caps with copper wires, it weighs only 23 pounds.

Although du Pont Waterproof Electric Blasting Caps have been on the market for some years, their use has grown so extensively during the past year that it seems desirable to call attention to them here. These detonators not only have a longer shell than the regular electric blasting cap to provide space for a longer column of waterproofing compound to protect the cap charge but they also have an enamel coating on the wires under the insulation. Even when water penetrates the cotton insulation, it can not reach the copper. This makes du Pont Waterproof Electric Blasting Caps valuable for firing a long line of holes in wet work, for even a minute quantity of earthy salts in solution gives the ground water so high a conductivity as frequently to cause current leakage from the wires of ordinary electric blasting caps with resultant failure of some of the center charges. The use of du Pont Waterproof Electric Blasting Caps with enamelled wires prevents misfires from this cause.

Foote Note

Foote Bros. Gear & Machine Co. have recently completed arrangements with Chas. Bond & Co., Philadelphia, Pa. for the distribution of their IXL Gear Products and Speed Reducers in Eastern Pennsylvania and Maryland, the State of Delaware and all of New Jersey south of Mercer County.

The Insley Excavator

AN Insley Excavator is being used by Polk County, Florida, at Frostproof for stripping an overburden of sand from deposits of red clay, and for digging this red clay for use in making roads. The overburden is about three feet in depth and a cut of six feet is made in the clay.

The Excavator handles about 400 cubic yards of clay which is loaded into trucks. It handles a larger amount of sand, which is cast in piles. The clay is used for surfacing roads, the work being done under the direction of Mr. Hancock, County Road Superintendent of Polk County. This same county owns three other Insley Excavators which are located at Brewster, Bartow and Winterhaven, Florida.

The Insley Excavator is made in three models, the shovel, which is shown herewith, the ditcher which can be used for working below grade for sewer ditching, basement work, stripping, etc., and the skimmer scoop which is of especial value on street grading and other work where the cut is light, and an accurate grade is desired. All of these machines have a capacity of 350 to 500 yards per day.

New Belt Conveyor Idler

,The Stearns Conveyor Company of Cleveland has put into service a new belt conveyor idler equipped with Timken roller bearings. The new idler was designed to be used either with the complete Stearns material handling equipment or to replace any type of carrier in use.

The pulley shells are made of number 10 gauge pressed steel drawn together with rod bolts. The through pulley shafts are fitted with roller bearings the same size as are used on the front axles of Ford automobiles. This bearing allows a large factor of safety and when wear does begin it can be compensated by adjusting a nut at one end of the shaft without removing the pulley from the carrier. The bearings are carried in heavy steel tubes inside the pulley shell.

One of the outstanding features of the carriers is the methods of applying high pressure lubrication. Grease applied to the high pressure fitting on the end of the shaft enters the grease reservoir near the center of the pulley. This forces the worn out grease from the bearings out through the washers. The grease seal formed in this manner prevents any dirt or grit from entering the bearing.

The Insley In Action.

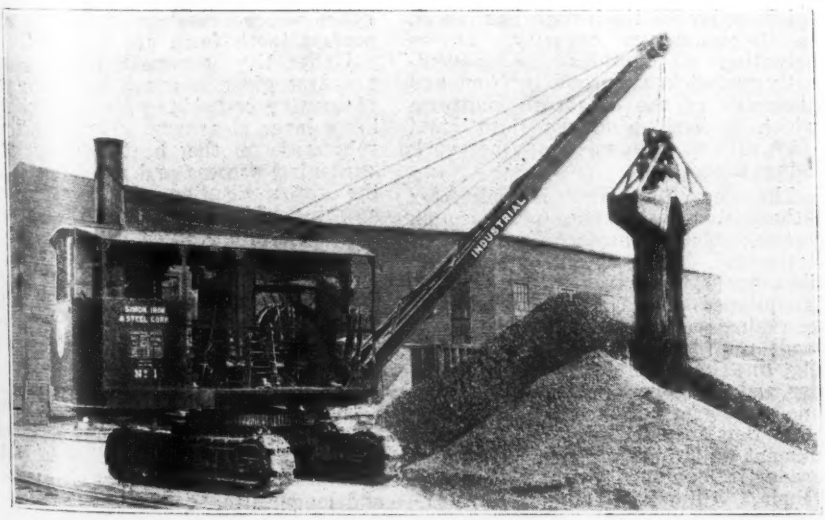
A New 10-Ton Crawling Tractor Crane

THE Industrial Works, Bay City, who recently designed and built several 200-ton locomotive cranes which were the largest in the world, now offer a new type at the other end of the scale. This is a 10-ton crawling tractor crane embodying many new engineering features and known as type "D".

One of the most important features is the independent control of the traveling, slewing and hoisting motions. These motions may be utilized in a variety of combinations which are said to result in a greatly increased speed and efficiency of operation. For instance, the hoisting and slewing motions may be combined in bucket work for operation at high speed and when traveling, the boom may be swung in any direction to clear obstructions. Slewing in either direction is accomplished without reversing the engine by means of a double friction clutch and a train of bevel and spur gears. A slewing brake holds the boom securely with a suspended load in any position. When operating on uneven ground, this brake eliminates any possibility of sudden rotation with its usual disastrous results. The vertical slewing shaft is located accessibly at the front of the crane close to the base of the boom, and since the power is transmitted at this point, there is no great slewing stress carried through the revolving frame.

The entire upper works rest on a rotating steel base, which insures rigidity and perfect alignment. This base rotates on four conical steel rollers which are easily accessible and which may be taken out without removing any of the parts or jacking up the crane. Heavy steel side frames which carry the shaft bearings are bolted to this rotating bed. These bearings are arranged on the outside of the frames so that any shaft may be easily removed without displacement of other parts. All running bearings are provided with replaceable bronze bushings. Wearing surfaces of all thrust bearings are separated by bronze washers and bronze collars are placed behind each bevel gear. All gears in the upper works are of cut steel. All oil pipes lead to the operator's platform, and the lubrication is accomplished by a pressure system. Clutches controlling the various motions are of a new friction type which are said to engage smoothly and without shock.

Tractor shoes are close fitting, smooth surface steel, and they operate over adjustable idle sprocket bearings which take up the slack in the tractor belt. Five large size rollers of 25" diameter on each side decrease traveling friction and keep the bearings high up out of the dirt. The steel bed plate mounted on the car body is cast integral steel with a circular roller path and external



The New 10-ton Industrial.

slewing rack. A steel hollow center post is pressed under heavy pressure into this base plate, taking all unbalanced stresses and forming a center of rotation for the super-structure.

The crane has two traveling speeds, and reversal of direction is accomplished by reversing the engine. Steering while propelling is accurately accomplished from the operator's platform through friction clutches and brakes controlling each tractor belt. Either belt may drive, coast or be held by brake in any degree to negotiate as sharp or wide a turn as desired. This propelling and steering mechanism is one of the exclusive features of this type "D" crane. It enables the operator to propel and steer the crane independently of all other motions with the boom in any direction. It is especially powerful, enabling the crane to travel up steep grades and over rough ground. Propelling up an incline skidway onto a flat car for transportation is very easily done. Other exclusive features are the automatic double hoisting drums which provide automatic control of the bucket during operation. Both drums provide enough rope pull as required for dragline and hoisting purposes. The feature of hoisting the bucket open on the auxiliary drum greatly increases the output of the crane and makes operation much simpler. A radius varying appliance consisting of bronze worm, worm wheel and drum, and controlled by friction clutches and semi-automatic brake, raises or lowers the boom when loaded to its maximum capacity. Levers actuating all motions are conveniently placed in two rows in front and alongside of the operator's platform which is located on the right hand side with a full view of the work being done.

The new Industrial is built for either steam, electric or gasoline power. The steam crane has two horizontal, double acting cylinders 6" diameter by 8" stroke. The engine is equipped with a simple radial type reversing gear, by means of which loads may be lowered and the hoisting line laid out by power. Cylinder and crosshead guides are cast in one piece and bored at the same setting, thus insuring accurate and permanent alignment. The gasoline crane is equipped with either the "Buda," Climax, Wellman-Seaver-Morgan or Automatic semi-Diesel engine at the option of the purchaser.

The crane is extremely versatile, operating with clamshell or dragline bucket, electro-magnet, hook and block or grapple. It is readily convertible into a shovel or a pile driver. The makers are confident that their new crane will supply a demand for a general utility crane of small capacity sturdily built. It should find a ready market in practically all fields of industry.

Grinding Spur Gear Teeth

DURING the past year, Foote Bros. Gear & Machine Co., has been making a number of improvements in their manufacturing equipment. Machines of older types have been discarded and replaced with more modern equipment in many departments and the whole plant brought up to the top notch of efficiency.

One of the interesting additions to the present equipment is an elaborate and expensive machine for the grinding of spur gear teeth. The distortion during the heat-treating processes to which heat-treated, cut spur gears are unfortunately subjected make it impossible to secure the absolute accuracy of tooth curves necessary for certain special gear applications. For some time the makers of high grade automobiles have been making use of a new method of producing absolutely accurate gears and Foote Bros. are now using this method in finishing spur gears where noiseless operations and perfect tooth form are essential.

Under the new method, the gears are first given a rough cut with the generating or hobbing machine, allowing a large clearance. They are then subjected to the heat-treating and hardening process and are finished on the automatic Gear Tooth Grinding machine. The gear tooth grinder is a machine equipped with a flat grinding wheel, which is dressed true with a diamond point. This wheel is moved through a marvelously accurate indexing mechanism along the form of a true involute curve of the pitch desired.

The advantages of spur gears finished on the gear tooth grinding machine are quietness in operation, elimination of vibration, back lash, greater efficiency, savings in power and longer life.

Osgood Developments

THE Osgood Company has seen during the past year the increasing popularity of their heavy traction mountings for the larger sizes of railroad type shovels.

This type of mounting was introduced to the industry a little more than a year ago by this company and the first installation was made on an Osgood "120," a 6 yd. steam shovel. These mountings were intended primarily for use on hard, smooth bottoms such as are found in most quarries, but it has been found that they can be used successfully on fairly rough bottoms. They have the advantages of simplicity of construction and low maintenance and shovels so equipped show greatly increased production, much saving of time in changing locations and decreased labor costs.

A large number of these installations have been and are being made in quarries throughout the country on machines that have been in service on railroad trucks for many years. In a number of quarries single installations were made for test purposes and in every case additional shovels have been mounted on traction wheels.

The company has also put on the market this year continuous tread mountings for the larger railroad type shovels, as supplementary to traction wheel mountings.

A noticeable tendency is the apparently increasing preference for the smaller sizes of standard revolving shovels in work which was formerly considered only suitable for railroad type shovels. A large number of Osgood 1¼-yd. machines are to be found in such work as stripping coal, digging and loading coal, quarry work and other installations requiring power and stamina.

Among the interesting machines built by the company during the past year are special compressed air shovels owned by the contracting firm of Hitchcock and Tinkler of Denver and used on the great Moffat Tunnel in Colorado. These shovels are special adaptations of the Osgood 43—normally rated as a 1½-yd. machine. They are of 3-foot gage, with narrow bodies, special jack arms, short booms and handles, and a 1-yd. rock type dipper.

The Osgood with Traction Mounting.

Kidwell Tu-Flo Boiler Booklet

A new 268-page catalog has been issued by the Kidwell Boiler Company of Milwaukee, Wis., manufacturers of The Kidwell Two-Flow Ring Circuit Boiler, Stacks, Breechings and Sundry Boiler Appurtenances. This catalog contains "a lucid explanation of the principles underlying correct boiler design and operation, their application to boiler analysis and how they are correctly applied in the design of the Kidwell Boiler, with other information valuable to those who wish to generate more steam for less money."

The book is dedicated to Goldsworthy Gurney of Cornwall, a pioneer investigator in the generation of steam, who is given credit for discovering the principle of ring-flow circulation. Chapter I is a general discussion of boiler development, methods and principles; Chapter II discusses General Principles Underlying Correct Boiler Design and Opperation; Chapter III A Few Applications of the Preceding Principles; Chapter IV, Evolution of the Ring-Circuit Boiler; Chapter V, "Requirements of a Perfect Steam Boiler" and Who Should Select and Operate It; Chapter VI, The Kidwell Two-Flow Ring-Circuit Boiler; Chapter VII, Chimney Stacks.

Brookville Locomotives

IN ADDITION to Brookville Locomotives with Fordson tractor power unit, which have been standardized in 3½ and 4 tons weight for the past year the Brookville Truck & Tractor Company have standardized their Ton Truck Model in four wheel drive which comes in 1½, 2 and 2½ tons weight. In their standardized Models they offer a product that has been made possible by seven years of efforts on their part, manufacturing gas locomotives from this reliable and standard power unit.

This light equipment takes care of a field, that during the past has been handled exclusively by mule and man power. Due to its light weight, small drivers, spring journals and extremely short wheel base of 30 inches it can be used over rail as light as 12 gauge section. Nor is rough and crooked track any serious obstacle as it can be used on any track that will accommodate industrial cars. When installation is made no expensive alteration of track is necessary. The equipment will handle the trip load of from one to three mules, depending on weight of machine used, and will make from two to three round trips while mules make one.

They are both reliable and efficient, and economical beyond belief. Power unit is strictly Ford ton truck throughout, plus auxiliary reverse which gives standard Ford truck drive in reverse work the same as forward. Or when desired at small additional cost they are supplied with four speeds both forward and reverse. Practically all wear is on standard Ford parts which can be secured from local Ford Garages.

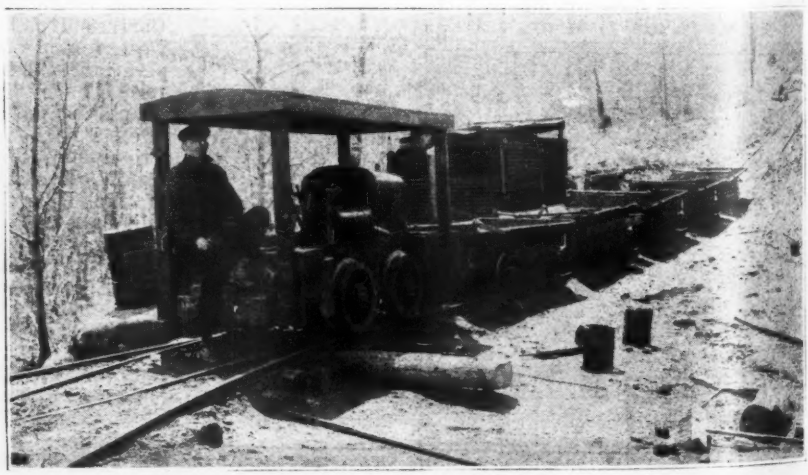
Wood Development

The Wood Hydraulic Hoist and Body Company considers that its most outstanding development in equipment during the year 1924 is the perfection of its Hi-Lift Outfit. Many producers have long awaited the development of a dependable Hi-Lift elevating truck body. This company claims it has perfected the lightest, strongest, and simplest type of Hi-Lift equipment yet devised.

As a result of an extensive study of the similar types of equipment already in the field they decided to use the Jack Knife principle for an elevating mechanism. Some of the special features in the Wood range of this equipment are two Hi-Lift positions of the body, extra low mounting, Hi-Lift mechanism sub-frame which reinforces the truck chassis and the use of standard parts throughout.

The mechanism has a simple and clean-cut appearance. All members are of straight structural steel. The high lifting arms are 5 inch 14¾ pound eye beams. The auxiliary arms are 5 inch 11½ pound channels. The sub-frame is built of 4 inch 8½ pound eye beams and protects the chassis frame at all points.

The Hi-Lift mechanism as the Wood Company builds it is for 3 tons.



The Brookville Locomotive.

Hadfield-Penfield Progress

THE progress of The Hadfield-Penfield Steel Company during the year 1924, while not as great as during the year 1923, has been very satisfactory to those in charge of the operation of this manganese steel foundry. It was not expected that the unprecedented growth during the years 1922 and 1923 could be maintained.

There has, however, been an increasing demand for "ERA" manganese steel castings and this has necessitated a number of improvements. Additional foundry facilities have been added, a new machine shop for the grinding of manganese steel castings has been installed, and an electric furnace put in operation for the manufacture of small castings.

In the year 1924, it has been found that "Era" manganese steel could be used for a variety of applications, that would effect operating economies, which were not formerly considered as manganese steel applications.

In the sand and gravel industry, new designs of chutes (chute plates), certain pump parts, chain and elevator buckets have commanded special attention, and an ever increasing demand has been created for this class of castings. One application will illustrate the economy in the use of the new design of a centrifugal pump part, which had an efficiency four times greater than the casting it replaced. In other words, this new pump part remained in service four times longer than the previous casting used. The actual saving amounted to 75 per cent of the first cost of the casting to say nothing of the elimination of the delay in making replacements.

Perforated screen plates, both cylindrical and flat, are finding a wider use, and we believe they have demonstrated the saving which may be effected by the use of a casting or plate which does not require frequent replacement. For elevator chains, elevator buckets, and screw conveyors, "Era" manganese steel has lightened the sections and reduced the weight of these castings until they now compare favorably in weight with malleable iron or other metal parts, while the manganese alloy will give a service which will approximate three to five times greater life than that obtained from other metals, without a proportionate increased cost.

Ever since manganese steel was first announced by Sir Robert Hadfield some forty years ago, the applications in which this special alloy metal can be used has increased with the years. Slightly more than twenty years ago there were about 3,000 tons produced per year. The total production of manganese steel will now approximate 80,000 tons per year. With the rapid developing of processes, of rolling and forging of manganese steel, the production will increase even more during the coming years. There is no question but what manganese steel has made possible the development of the machinery which is now so efficient in the production of sand, gravel, crushed stone and cement.

The Hadfield-Penfield Steel Company are always willing to devote the time of their engineers to assist in conducting experiments, or a test to determine whether manganese steel will reduce operating economies. No plant superintendent or operating official need hesitate in sending problems to this company as they will receive every consideration and co-operate with them in every way consistent.

E. E. Klooz says,

"All indications in the foundry sand trade point toward a year of largely increased volume at a small margin of profit. Forward buying has not as yet superseded the "hand-to-mouth" policy in effect for the past year. A change in the policy, however, will not make a runaway market as all the producers of foundry sands are carrying larger stocks of finished material than is customary.

The most encouraging feature for a good business year is the railroad situation. The past election has largely removed the fear of radical railroad legislation, which would hamper our transportation facilities. It is evident that the railway authorities are taking this view of the situation and are making commitments in preparation for putting the systems in first class condition. A continuance of this policy will be felt in every line of business and bring out the latent buying power of the country, making for a large volume."

E. E. Klooz,
Vice Pres. and Gen. Mgr., The Portage Silica Co.

Haiss 1924 Improvements

DURING 1924 the George Haiss Manufacturing Company brought out a new wheel-equipped Fordson Loader which varies from the old type inasmuch as this loader can be propelled into the pile while the elevator is in action.

This result is obtained by installing a cast steel take-off box between the fly-wheel and the clutch of the Fordson Tractor. The tractor is disconnected in the center by taking the bolts out of the fly-wheel housing and installing the Haiss take-off box and attaching the rear end to the box. This puts the clutch in back of the take-off so when it is desired to propel the machine into the pile, the elevator clutch is not disconnected.

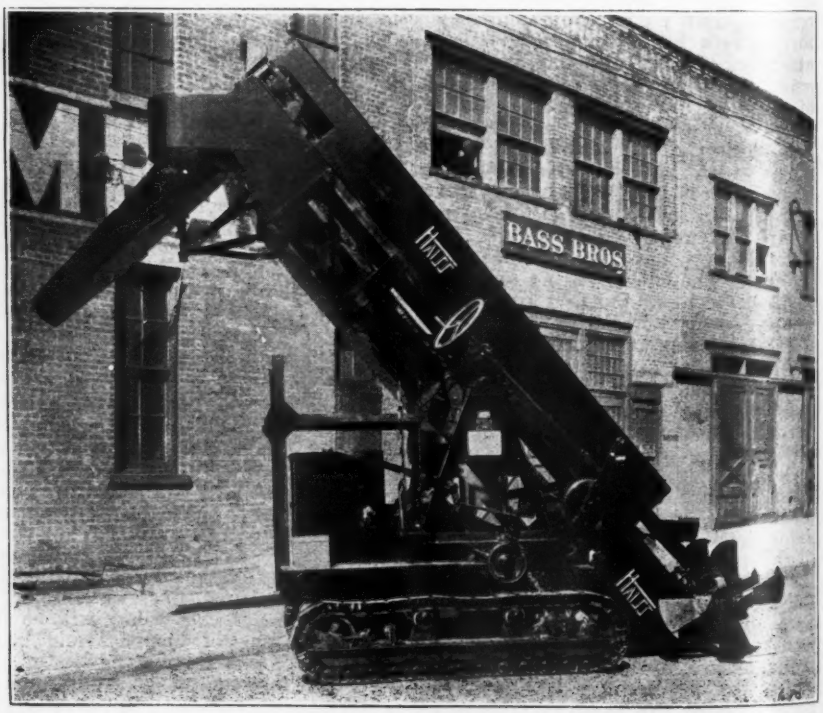
During 1924, they also made improvements on the Haiss Creeper Path Digging Loader. It is now equipped with a 37 H.P. Waukesha engine with a Ricardo cylinder head. The length of the creeper treads have been increased and now there is a bearing pressure on the ground of only 8½ pounds to the square inch. The weight of the loader is 14,000 pounds.

The guards on top of the elevator have been increased in size to prevent material falling on the operator. All bearings, etc., are equipped with Alemite lubrication. The size of the clutches has been increased, and all run in a bath of oil. The creeper tread links have been redesigned so that it is impossible for mud or dirt to wedge. The feeding propellors have been made heavier to prevent bending. The elevator length has been increased to give a higher discharge height.

James Leenhouts says,

"With money plentiful, labor well employed, the farmer coming back and the European situation clearing, we may confidently look for good business conditions for 1925, with the building industry in the lead."

James Leenhouts,
Treas. and Gen. Mgr., Grand Rapids Plaster Company.



Haiss Loader Mounted on Fordson Tractor.

Some Westinghouse Achievements for the Year 1924

By H. W. COPE*

THE world, during the past year, has seen many achievements of a most spectacular nature. The American "round-the-world" fliers have successfully completed their circuit, the first daylight-to-dark-transcontinental flight was accomplished, and the ZR-3 easily crossed from Germany to Lakehurst, N. J. The Dawes reparations plan has been accepted by the Allies and has been put in operation in Germany.

By means of the use of short wave lengths, broadcasting ranges have been vastly increased so that, by means of relaying, practically every corner of the civilized world is now receiving programs from KDKA, the "Pioneer Wireless Telephone Broadcasting Station of the World."

The world is moving forward with tremendous speed and it becomes almost impossible to keep abreast of the times. It is very fitting, therefore, that one of the great companies, whose developments each year becomes greater and greater, should pause for a moment as the year draws to a close and "take stock," as it were, of what has been done and achieved during the year just passed.

Many items of interest are to be found by such a review, some of them spectacular due to their physical proportions and others, seemingly small today, which may be the embryo of achievements even more remarkable in the days that are to come.

KDKA, the "Pioneer Broadcasting Station of the World," has reached to all parts of South America and Europe, and is today the most powerful and the greatest station ever known.

Turbines, turbo-generators, synchronous condensers, motor-generator sets, rotary converters and transformers are being built in larger and larger sizes. New and improved types of drive and control have been devised for the more successful and accurate use of this electrical machinery. Switching equipment of the truck type and automatic-supervisory control are becoming more and more popular. Improvements in these have been made and today they operate the machinery with better results than when under manual control.

In the field of transportation, we find that Diesel-electric drive is being most successfully applied to all manner of ships, from the graceful pleasure yacht to the oil tanker and New York Harbor tug. This same form of drive has also been applied to a self-contained locomotive of a size and capacity not attempted up to this time.

A larger number of electric locomotives has been placed in service than in any previous year. Almost every type and system are represented from 600 volts D.C. to 3000 volts D. C., as well as single phase, split phase, and motor-generator types operating under the 11,000 volt, single-phase trolley.

An accurate method of balancing rotating machinery has been developed that can be operated by almost any one. A means has been devised for eliminating the vibration caused by the pulsating torque of single-phase machines. New methods for driving steel mills, rubber mills, paper mill, and the drilling of oil wells have been perfected.

Several new types of instruments have been developed, among are mentioned the Klydonograph and the Kv-a. meter, while others, such as the oscillograph and the watthour meter, have been vastly improved.

A special design of condenser has been brought out to serve the 52,000 kw. compound turbine mentioned previously. This condenser is built in two shells containing a total of 70,000 square feet of tube surface. It is set vertically on either side of the low-pressure turbine element and rigidly bolted to the latter, forming in effect a single structure.

The arrangement of the tubes, in a vertical position, requiring the condensate to fall on and flow over the lower tube plate, causes a temperature depression of the condensate. A special hot-well or condensate heater has been provided to restore this temperature.

The condensate is drained by passages down through the tube plate and out through the side of the lower water box, where pipe connection is made with the water inlet compart-

*Assistant Director of Engineering—Westinghouse Electric and Manufacturing Company.

ment surrounding the upper part of the hot-well.

The flow of condensate to the hot-well is caused by gravity assisted by a slight pressure differential set up through a vent connection from the middle part of the hot-well to the condenser at a point where the vacuum is maximum.

The condensate is sprayed through nozzles into the central part of the hot-well which is open to the exhaust casing of the turbine, and absorbs heat from the exhaust steam with which the upper part of the hot-well is filled. This is in effect a small jet condenser used as a feed-water heater. The non-condensable gas from the steam condensed in this heater is drawn through the vent connection to the main condenser, and the heated condensate is removed by a condensate pump in the usual way. Suitable baffles in the upper and lower parts of the hot-well form water seals to prevent by-passing the exhaust steam to the condensate pump or to the main condenser.

During the past year, the Company has made a careful analysis in the field to determine the ratio of heat transfer through the tubes in various zones of surface condensers. This study will be of material benefit in the design of more efficient condenser units.

A number of marked improvements have been made in the design of the Company's stokers during the past year, among which are the following:

A new model underfeed stoker for use with preheated air.

A modified clinker grinder equipment for the successful handling of low grade coal.

An extra long, 33-tuyere stoker.

A device to prevent the formation of clinkers.

An effective junction of extension side-wall tuyeres with air distributing boxes.

A simple and effective secondary ram motion.

A more simple steam dump mechanism.

A careful investigation has also been made with a view to determine modifications necessary in furnace design in order to decrease furnace temperatures.

Due to the increased use of preheated air for combustion purposes, much higher temperatures on stoker parts in the wind box are experienced. This has required the modification of the tuyere box from a one-piece casting to one having retort side plates in three sections assembled with splice plates on angle-iron supports to form the unit retort. This was necessary because of the uneven strains in the castings causing cracks and expensive replacement charges.

With the new design, the joints in each retort side provide for taking up the expansion and thus relieve any strains which might otherwise develop from an increase in the temperature of air combustion. The sizes of castings are made more nearly uniform, and excessive expansion in any individual piece is prevented. Replacements can be made more readily and are considerably less expensive. All plates are drilled to a master jig, making all replacement parts interchangeable.

One of the effects of using preheated air for combustion is the much greater depth of which the fuel bed burns—particularly in the retort. The Company's new type of construction eliminates any possibility of trouble from this cause and makes the New Model Stoker well adapted for use with preheated air.

At one time, clinker grinders were not considered suitable for low-grade coal and were used only with fuels of higher grade. Recent study and development have proved the fallacy of this belief, and clinker grinders for low-grade fuel were made with a wide clinker grinder pit of wedge shape. This design, however, did not prove successful from an operating standpoint. There was no means provided for agitation at the entrance to the pit. The width of the pit was so great that an active fuel bed could not be maintained across it, resulting in an infiltration of cold air, and causing decreased efficiency. The wedge shape of the pit prevented the free discharge of clinkers due to their wedging. Clinkers of large size would form at the lower end of the stoker without any means for dislodging them or breaking them up, causing increased trouble.

With the Company's latest type of clinker grinder, the width of the pit has been very materially decreased. The sides of the pit are only slightly converging. The lower end of the stoker is provided with an extension agitating grate just at the entrance of the clinker grinder pit. This is actuated by a steam piston cylinder providing sufficient agitation, prevent-

ing the growth of clinkers to troublesome sizes.

Recent tests have shown that, with very low-grade fuel, highly satisfactory results are obtained, and have clearly demonstrated that the successfull handling of low-grade fuel is assured on stokers equipped with the Company's clinker grinder.

Certain low-grade coals form sheets of clinker across the stoker at the lower end of the retorts, and an effective device has been developed by the Company to prevent the formation of this clinker. This consists of a special retort bottom casting recessed to form a small pool for water which is fed to it slowly under low pressure. The quantity of water used is not sufficiently great to affect the combustion efficiency appreciably. However, the chilling effect of the water on the clinker at this point is most effective in disintegrating it. The disassociation of the steam thus formed, into hydrogen nad oxygen, completely oxidizes the surface of the small clinkers and prevents their sticking together to form a large sheet.

A very satisfactory method has also been devised to prevent the collection of any sediment in the water piping system to this pool. This consists in the provision of a compressed air connection so that the piping and outlets may be thoroughly cleaned by a mixture of air and water under pressure.

An effective junction of the extension side-wall tuyere with the air distributing boxes, which eliminates the pocket at the front corner of the furnace, has been devised. This prevents the lodging of burning fuel at the corners of the furnace and overcomes the possibility of gases being blown out of the stoker at this point. A much better distribution of air to this part of the stoker is also obtained.

In the Company's older types of stokers, the secondary ram was driven by two rods connected to the primary ram, resulting in a motion of the former in synchronism with the latter.

The secondary ram is now driven by a single rod so connected through a rocker ram to the primary ram that the motion of one opposes the motion of the other. This modification has resulted in a marked improvement in the manner of introducing fuel to the furnaces. The alternate compressing and expanding of the fuel due to the combined motion of the two rams gives a fuel bed structure of such a nature that the air is more readily forced through it. The weight of coal per stroke of primary ram has been increased 10 per cent due to the opposite motion of the secondary ram opening a space in front of the primary ram just as the new charge of coal comes into this space.

A new type of steam dump mechanism has been devised which is much more compact than formerly. Provision has been made for the adjusting of the position of the cylinders which was impossible under the old construction. Much greater accessibility to the various parts is also a feature.

Considerable research and development have been required to determine the features of design necessary to keep furnace temperatures within the limited range of present refractory material. This problem inevitably has become a part of the stoker problem, requiring quite as much attention as the stoker itself. The elimination of bridge walls where possible and the proper shaping of back walls, together with the exposure of the greatest possible tube surface and the radiant heat rays of the fuel to them, produced most gratifying results, reducing furnace temperatures in some cases as low as 250 degrees Fahrenheit. Many customers, in following the recommendations of the Company's engineers, have been able to obtain much better installations.

The company has developed and placed in successful operation several large-sized, single-flow turbines using a multiple exhaust arrangement of the low-pressure blading. No less than seven large public utilities are now using these turbines.

For industrial size turbines, a hydraulic type of governor has been placed in successful operation. This new form of governor has proved much more durable, more sensitive and more powerful than governors formerly used on this type of machine.

A new arrangement of steam chests for large capacity turbines has been developed. These were formerly mounted on, or attached to, the turbine cylinder, but are now bolted to the foundation with flexible pipe connections to the turbines. With this new arrangement, extreme flexibility in the supply line from the main header is not necessary.

The economy of the 10,000 kw. and 12,500 kw. turbines has been considerably improved by modifications

made to the frame. Openings have been provided in the casting for the extraction of partially expanded steam for feed-water heating. Very marked improvements in the economy of existing stations have been made by the installation of a new unit of this type arranged for the extraction of sufficient steam at several points for the purpose of heating the entire station feed-water.

A new 3,500 kw. turbine has been developed and a new 6,000 kw. machine is being designed. Both of these units will operate at 3,600 r.p.m. for 60-cycle systems. They will be similar in general design to that so successfully used in the 500 kw. to 3,000 kw. sizes previously developed.

A 15,000-kw. machine operating at 1,800 r.p.m. for 60-cycle systems has been developed. This is a single cylinder, single-flow unit, having a combination of impulse and reaction blades. It is arranged with flanged openings for the extraction of partly expanded steam from several stages of the turbine for feed-water heating purposes.

A 3-cylinder compound turbine unit with condensing equipment, having a capacity of 52,000 kw., has been installed. This unit is supplied with steam at 550 pounds pressure at 725 degrees temperature, and provision is made for reheating in the boiler to 700 degrees of the steam discharged from the high-pressure turbine in the course of its discharge from the intermediate pressure element. Shipment has also been made of the first of two 50,000 kw. cross-compound turbines. These are 2-cylinder units, each turbine driving a generator carrying one-half the total load. Coupled to the generator end of the low-pressure turbine is the exciter for both generators, while the high-pressure generator shaft drives an auxiliary generator furnishing power to the station auxiliaries.

The company has recently devised and placed in operation an equipment for "seasoning" completed turbine spindles under operating temperature conditions before final balancing. this consists of a cast-iron heating box in which a fully bladed spindle can be heated to 400 or 500 degrees Fahenheit, or subjected to a vacuum while being rotated at 20 per cent overspeed. It has been found that spindles so treated and balanced run most satisfactorily when placed in service.

Careful study and research is being given by the company's engineers to the question of the natural period of vibration of turbine blading. Experimental results so far obtained show that natural vibration frequencies of certain blade sections at room temperature, if subjected to centrifugal force, check very closely with calculated estimates. The effect of temperature on the modulus of elasticity of blading material is now the subject of an exhaustive study. The effect of centrifugal force may be accurately calculated, so that knowing the dimensions and material of any given row of blading, its natural frequency can be calculated to determine whether or not it is different from the rotating speed of the machine. Careful study of the blade designs in use show that practically all blading of the company's turbines has a natural frequency considerably above the rotating speed.

Successful trials have been witnessed of the company's geared turbine propelling machinery on the Scout Crusiers "Omaha," "Cincinnati," and "Milwaukee," and also of the company's turbine electric propelling machinery on the Battleships "Colorado" and "Tennessee."

New Fellowship in Highway Engineering

The United Fuel & Supply Co., of Detroit, has recently established a fellowship in highway engineering to be devoted to investigations under the direction of the Division of Highway Engineering and Highway Transport of the University of Michigan covering advisable methods of sampling and testing sand and gravel to be used in connection with highway improvement. The United Fuel & Supply Co. fellow will make an extensive investigation of plant production of sand and gravel prior to determining efficient methods of sampling.

Annual Meeting of Contractors

The 6th annual meeting of the Association General Contractors of America will be held January 12th, 13th and 14th in Washington, D. C.

The office of the Stony Creek Gravel Company is at Willows, Glen County, California. Mr. H. S. Twede is manager of the plant. Mr. H. E. Smith is in charge of sales and Mr. W. K. Knowles handles the auditing.

New Milwaukee Gasoline Locomotive

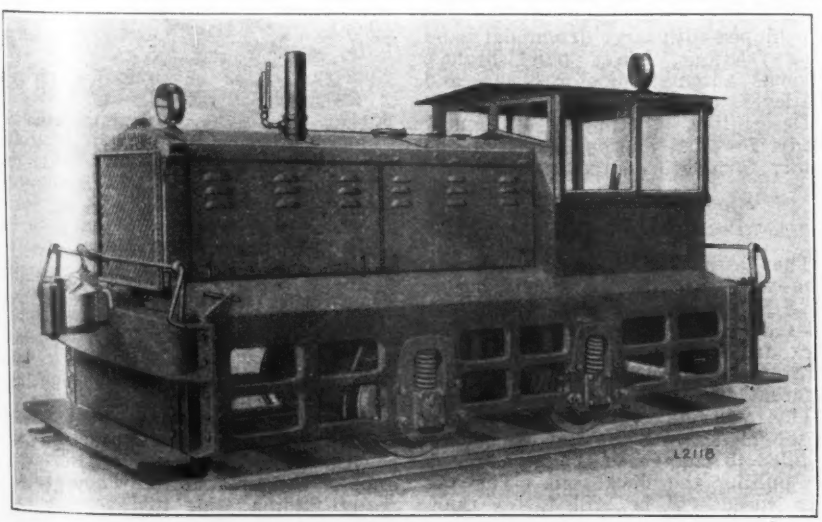
THE Milwaukee Locomotive Manufacturing Company of Milwaukee, Wisconsin, has added to its line a new and larger model of its well-known type "H" gasoline locomotives. This locomotive is known as the type "H" 15, a 15 ton machine which is furnished for all track gauges from 30 to 56½ inches. Like the smaller sizes of this type it has gear and chain drive with 4 speeds of 2, 4, 6 and 12 miles per hour, both forward and reverse. The frame is made up of massive steel side frames of the open bar type with reinforced channel iron end sills. The design of the frame is such that the center of gravity is very low being only 36 inches above the rails, which greatly eliminates the tendency of pitching and rocking.

The axles are made of steel forgings heat-treated and are fitted with heavy duty roller bearings. Dust-proof journal boxes are employed, the journal box yokes being so designed as to provide ready means for chain adjustment. The springs are of such size and resiliency as to assure easy riding; and the wheels are steel tired, 30 inches in diameter with standard M. C. B. flange.

The hood and cab are of reinforced steel construction. The cab is exceptionally roomy and is provided with wire glass, sliding side windows, window over hood and rear curtain. It is so designed that the operator sits crosswise in the cab when in driving position, giving him a clear and unobstructed view of the track when driving in either direction. The hood has removable hinged steel side covers provided with swivel spring hood latches of the automobile type. The entire hood and cab may be readily dismantled by merely removing a few bolts and cap screws.

The entire power unit is mounted on a substantial sub-frame, insuring rigidity and perfect alignment. The construction of the sub-frame is such that the entire power unit may be easily and quickly removed from the locomotive proper when necessary. The locomotive is powered with the very latest and advanced type of six cylinder engine, having a 5¾ inch bore, and a 7 inch stroke, especially designed for heavy duty service and capable of developing 115 H. P. at 100 R. P. M.

The engine is equipped with a maximum speed regulating governor which prevents the running of the engine above the normal speed of 1,000 R. P. M. It is also equipped with a two spark high tension magneto and impulse starting coupling. The carburetor is a Wheeler-Shebler model with low and high speed adjustment, especially adapted to the needs of heavy duty engines. The engine is also equipped with an auto-



The New Vulcan Locomotive.

matic air cleaner and has forced water circulation and forced feed lubrication. A multiple disc clutch is used, the clutch having ten driving discs and eleven driven discs. The transmission is of the jaw clutch and gear type and provides 4 speeds of 2, 4, 6, and 12 miles per hour both forward and reverse. In this transmission the gears are always in mesh, the design being such as to eliminate all possibility of stripping the gears. The very highest grade of chrome vanadium steel roller chains, having a tensile strength of 95,000 pounds are employed to transmit the power from the transmission drive shaft to the axles. The brakes are of the conventional hand operated, four wheel spread type, but straight air or automatic breaks can also be furnished when specified. The sanders are hand-operated, the sander box being located under the hood where the heat from the engine has a tendency to keep the sand dry and free running. This locomotive is equipped with a 12-volt electric lighting and starting system, consisting of generator, starter and Westinghouse Storage Battery.

New Thomas Hoist

The Thomas Elevator Company, 20 South Hoyne Ave., Chicago, have recently designed and developed a new single friction drum, electric hoist, especially adapted for quarry service.

This hoist is of heavy design and is equipped with large drum, slat band type frictions, heavy band brakes, Thomas automatic motor brake, and the levers are banked in quadrant.

Descriptive bulletin No. 42 is now ready for distribution, and will be gladly furnished on request.

New O. K. Hoist

The O. K. Clutch and Machinery Company are now manufacturing a 70 H.P. three drum hoist which will have two speeds throughout. The back drum is extra large and has a different speed. In all there are four different speeds on the hoist.

This will make it possible to dig on the low speed then after the bucket is filled to change to the high speed for pulling the bucket in. The return speed will be still faster than the high incoming speed as there are two speeds on the outgoing line.

The New Denver Hammer Drills

DURING the year 1924 The Denver Rock Drill Manufacturing Company have devoted their efforts to the perfection of a new line of compressed air operated hammer drills. In all these new machines the valve rotation of the drill steel is independent of the hammer action. Drop forgings, high grade alloy steel and steel are used throughout in their construction and in each machine the weight is held to the minimum necessary to insure durability.

The new series comprises:

Model	Class	Weight
331	Drifter	146 lbs.
34	Drifter	225 lbs.
337	Drifter	125 lbs.
37	Sinker	65 lbs.
39	Stoper	99 lbs.

The design, materials, heat treatments, and precise manufacture all contribute to the superior performance of these machines. They are already finding wide and satisfactory application in the non-metallic mineral industries.

Mechanical Stokers

The Condensed Catalog of Mechanical Stokers, just issued by the Stoker Manufacturers Association of Detroit, is an exposition of the service rendered to industry by the member manfacturers collectively.

This catalog "was conceived as an important step in putting before the industrial world the breadth of service performed by mechanical stokers and the engineering organizations behind them." In it is offered a brief but complete description of all prominent makes of mechanical stokers.

The companies represented in this association are: American Engineering Co., Philadelphia, Pa.; Babcock & Wilcox Co., New York City; Burke Furnace Co., Chicago; Combustion Engineering Corporation, New York City; Detroit Stoker Co., Detroit, Mich.; Green Engineering Co., Chicago; Illinois Stoker Co., Alton, Ill.; Laclede Stoker Co., St. Louis, Mo.; Sanford Riley Stoker Co., Worcester, Mass.; B. F. Sturtevant Co., Boston, Mass.; United Machine & Manufacturing Co., Canton, O., and Westinghouse Electric & Mfg. Co., Philadelphia.

Amsco Manganese Steel Products

THE new products brought out during the past year by the American Manganese Steel Company of Chicago Heights, Ill., are the Woven Design Cast Manganese Steel Screen and the Mullaley Reversible Dipper Tooth.

The Manganese Steel of which AMSCO Screens are made becomes smoother under abrasion, and as it grows smoother it gets tougher and more resistant; the abrasive process is retarded rather than accelerated as it goes on. The Woven Design Cast Manganese Steel Screen has all the advantages of a woven wire screen with the additional advantage of being cast in one piece. It makes an ideal screen for heavy work and can be furnished with openings ⅝ inch or larger. It is claimed that Manganese Steel Screens provide greater screening efficiency as the holes maintain their size and shape for longer periods.

The Mullaley Reversible Dipper Tooth was designed by AMSCO engineers to overcome the common difficulty due to the points becoming loose and dropping off the dipper, and also to provide an efficient tooth for all kinds of digging.

Some of the advantages of this tooth are: The bolts are provided for holding on points; bolts are put in at an angle and tapered so that the point can be drawn up perfectly tight on the base; a complete cross flange on the base portion has effect of transmitting all strains, horizontal or vertical, to at least three flanges at one time; four individual tapered flanges on base cause points automatically to tighten when digging, also when under side strains; lugs at intersection of base and point make a positive lock.

New High Marks in Car Movement During 1924

1. Greatest number of cars loaded during any one week in history, 1,112,345 cars week of October 25th.
2. New high record for grain and grain products for any one week, 72,474 cars week of October 25th.
3. New high record in the loading of merchandise and L. C. L. freight 259,617 cars week of October 11th.
4. New high record in loading of miscellaneous freight, 422,890 cars week of October 25th.
5. New high record in movement of both loaded and empty freight cars, 1,030,211 moved in one day, Wednesday, October 15th.
6. New high record in respect to number of surplus cars and locomotives when loading was in excess of million a week. No car shortage or congestion due to railroad disability.
7. New high record in total loading of all commodities except coal, coke and ore for period January 1st to October 25th.

Chairman Homer

Mr. C. A. Homer, Vice-president of the Missouri Portland Cement Company, will be chairman of the entertainment committee of the Ninth Annual Convention of the National Sand and Gravel Association in Chicago, January 5th to 7th.

The hotel accommodations in Chicago are ample to take care of all who attend the convention, but Secretary Barrows suggests that written reservations be sent in at once if possible and that any member who has difficulty over reservations wire the Washington office of the Association.

100-Ft. Portable Compressor

The 100-ft. Chicago Pneumatic Gasoline-Engine Driven Portable Air Compressor developed during 1924 fills the much-wanted requirement for a compressed air unit handling one rock drill. This compressor will also operate two concrete busters or two clay diggers; two riveting or calking hammers or four backfill tampers.

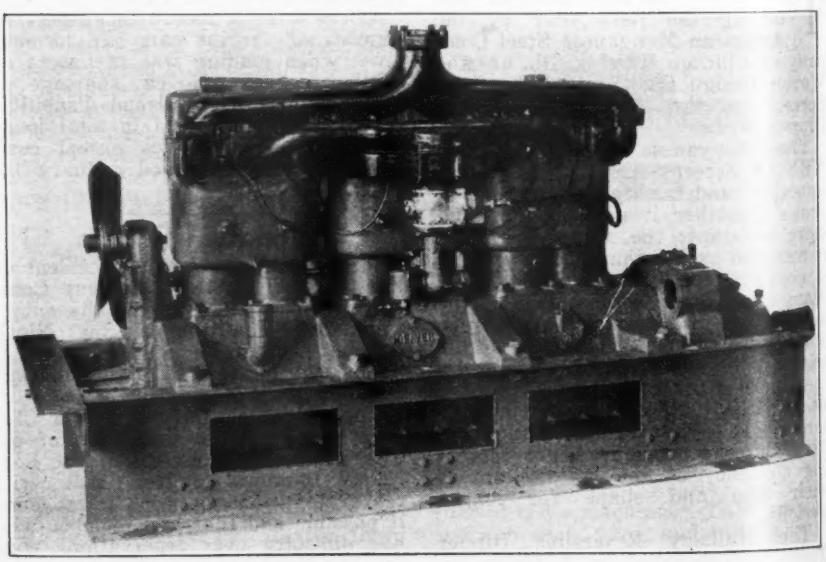
The compressor is of the vertical, single-acting duplex type equipped with Simplate Inlet and Discharge Valves. The CP Differential Unloader regulates the air supply and the Auto-Pneumatic Throttle provides additional fuel economy by slowing the engine to idling speed during the unloaded periods and speeding it up again just before the load is resumed. Splash lubrication is used and a small pump, gear-driven from the crankshaft, maintains a constant level of oil in the connecting rod splash-troughs and supplies oil to main bearings. Glass inserts, in the removable doors of the crank-case, are convenient for the inspection at all times of the lubrication system.

A flexible coupling, which can be quickly disconnected for starting, when desired, connects the cmopressor directly to a heavy-duty four-cylinder gasoline engine. Both engine and compressor are thoroughly cooled by a large capacity radiator, built in sections and protected against damage by seven vertical bars. A cast-steel deck provides a common base for engine, compressor and air receiver. The gasoline tank is carried in a separate section of the tool-box which may be locked when so desired. The complete unit is supplied in the regular steel-wheel or rubber-tired portable model, the rubber-tired trailer type or mounted on a 1-Ton Ford Truck chassis.

New Beaver Engine

THE Beaver Manufacturing Company, Milwaukee, Wisconsin, has recently designed a new 130 horsepower heavy duty Beaver engine. This engine is ideally adaptable to use on heavy-duty equipment going into the construction field, pit and quarries, sawmills and the like. This special model will operate at speeds from 800 to 1,000 RPM and develops 130 horsepower at 1,000 RPM, which is better than the 110 horsepower at 800 RPM. In face of this service this Beaver engine still embodies the characteristics which have gained a nation-wide reputation for Beaver engines in heavy-duty service.

The Beaver engine is of the valve-in-the-head type; all moving parts are fully enclosed and are dustproof. It has a force feed oiling system to all main and connecting rod bearings. The pistons and pins are lubricated from the splash.



The New Heavy Duty Beaver Engine.

Allis-Chalmers New Developments

DURING the year 1924 a number of new developments have been made in products of the Allis-Chalmers Company and several fairly large crushing plants designed by Allis-Chalmers Manufacturing Company have been put into operation, or are now under way.

The new line of style "N" crushers has been considerably improved by the use of a two-stage centrifugal pump mounted on eccentric which makes the oiling system entirely self contained and does away with all outside piping, geared oil pump, strainer, check valve and oil pressure gauge.

Improvements have also been made in the self-tightening device for the crusher head or mantle, making its operation more positive and this, together with the improved oil pump, makes it no longer necessary to predetermine direction of rotation at time of assembly. The style "N" crusher will run in either direction equally well, and direction may be changed any time without affecting its operation. Improvements have also been made in the dust ring and pinion shaft opening covers, making the dust proof features more positive.

The company is at present engaged in consolidating its lines of elevators for crushing plant work. Their entire line of cement machinery is being improved from time to time as experience dictates and as new ideas are brought out.

The compeb mill has been improved by the adoption of cast steel manhole doors and frames on the larger mills, greatly strengthening the shell at the openings. Improvement has also been made in the manufacture of the grid bars of the division head.

The rotary kiln has also been improved by the adoption of the floating type of riding ring in place of rings riveted to the shell. This eliminates loose riding ring rivets.

During 1924 the acquisition of the crushing and cement machinery line of the Worthington Company has added the well known Superior McCully Gyratory Crushers and the original McCully crushers to the products of the Allis-Chalmers Company. They have all patterns, drawings and stock received from the Worthington Company and are keeping the stock up as requirements demand, being in excellent shape to take care of new requirements and repair orders. The lately perfected Superior McCully Reduction Crusher is being made in two sizes—6" and 10" as are all other standard sizes of Superior McCully Crushers.

During 1924 the No. 21 crushing plant of the Wagner Quarries Company at Sandusky, Ohio, and the 36" Superior crushing plant of the Consolidated Stone Company, Kansas City, Missouri, were put into operation. Both plants are equipped with Allis-Chalmers crushers, screens and motors.

Link-Belt Erects New Warehouse

Owing to the greatly increased demand for Link-Belt products and close range service, the Link-Belt Company has erected a new warehouse and office building at 5938 Linsdale Avenue. The building recently being completed, the Detroit branch has moved to their new home, from their former quarters on Woodward Avenue.

The new structure is two stories and houses not only the general office for the Detroit branch but a large warehouse where standard Link-Belt and H. W. Caldwell & Son Co., products are kept in readiness for immediate shpiment. This stock includes the various types of chains for elevating, conveying and power transmission purposes, sprockets, clutches, malleable iron elevator buckets, etc.

In commenting upon the acquisition of the new home, B. H. Lundahl, manager of the Link-Belt Detroit Office, said: "Our Detroit office has grown with the City of Detroit and we are very optimistic regarding our future. We are confident that the establishment of large stocks in Detroit will enable us to materially better our heretofore good service, thus being of greater benefit to our many customers throughout this territory."

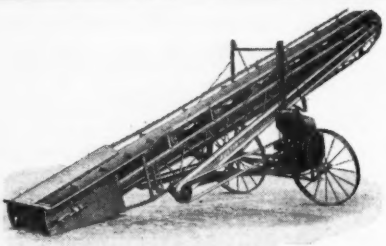
Crushed stone in the Pittsburgh market holds at $2.85 per cubic yard, 1½-in. and ¾-in. sizes, a figure which has prevailed in the wholesale market for many months past. Building material dealers are asking close to $4.00 a cubic yard for material delivered on the job. Portland cement shows no change from a $2.19 per barrel level, wholesale, in carload lots, f. o. b. city.

Our Inspection, Testing and Consultation Service Will Save You Money

Expert surveys and laboratory tests of Sand, Gravel, Limestone and other deposits. Inspection of new and second hand cars, locomotives, cranes, dredges, steam shovels, pumps, engines and all classes of pit, quarry and mill equipment.

ROBERT W. HUNT COMPANY

NEW YORK PITTSBURGH **CHICAGO** ST. LOUIS SAN FRANCISCO



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Austin Portable Conveyors

Made in two styles and all lengths between 16 and 68 ft. Furnished without power, or with gasolene or electric drive. Unmounted, or with 2 or 4 wheeled trucks as length requires. Write for special literature and prices.

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New Holland
ROCK CURSHERS FOR FINE GRADES

The economical method of crushing fine stone is to use New Holland Crushers. They are especially adapted to fine crushings or recrushings; they reduce material to all grades down to sand. They run easily—no hot bearings—and produce the least possible dust.

Write for our catalogue on crushers, elevators and sceens.

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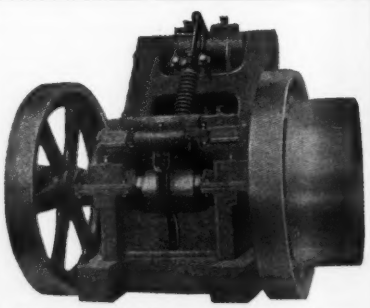

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